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Contents

- | | | |
|-----|---|---------------------------|
| 125 | Financing Public Education in
the Decade Ahead | <i>Roald F. Campbell</i> |
| 136 | Education and the Human Quest:
What's To Become of Johnny? | <i>Herbert A. Thelen</i> |
| 152 | Spontaneous Schooling and Success
in Teaching | <i>J. M. Stephens</i> |
| 164 | Evolution in the High-School Curriculum | <i>Sir Julian Huxley</i> |
| 176 | Inquiry, the Science Teacher, and
the Educator | <i>Joseph J. Schwab</i> |
| 196 | Educational Measurement: An Aid
to School Administration | <i>Arthur E. Traxler</i> |
| 210 | Theory in Educational Administration | <i>James E. McClellan</i> |
| 228 | The Fate of Postwar Educational
Reform in Japan | <i>Michiya Shimbori</i> |
| 242 | Book Reviews | |
| 245 | From the Publishers | |

In This Issue

Experts are predicting that by 1970 almost sixty million young people will be attending our public schools and colleges. This record-breaking enrolment will require a record-breaking budget for education. Thirty billion dollars is the estimate reported by ROALD F. CAMPBELL, who explores for readers in and out of the teaching profession the question of where the funds will come from.

However vast our school enterprise, the heart of this venture is the individual child. HERBERT A. THELEN's four-year-old Johnny walking through the park is every child at the beginning of his voyage of discovery, every child with a quest of his own. What the school does with this quest—with every child's quest—is the concern of this educator.

Do our classrooms waken the sense of wonder that SIR JULIAN HUXLEY writes of? Do they hold up the marvels of a universe in which the drama of creation is eternally unfolding?

Does our teaching recognize, as JOSEPH J. SCHWAB points out, that the creative inquirer is not a mere master of fact, but a restless scout, exploring the frontiers of knowledge, alert to the unexpected, prepared to pay the price of pioneering?

Whatever expectations we hold for our schools, in the end it is the classroom teacher who day by day translates the school program for the children intrusted to her. Can we know in advance which teachers will make the classroom a place where learning thrives? J. M. STEPHENS suggests that we look for clues in powerful, primitive forces that have moved teachers in all times.

While teachers have responsibility for the day-by-day guidance and direction in the classroom, school administrators shoulder a large share of the responsibility for the over-all direction of our public schools. JAMES E. MCCLELLAN presents a portrait of today's administrators and discusses administrative theory that is being developed to guide this group of educators.

Besides a growing body of theory on administration, today's school executive has at his service a wealth of information in the form of results of standardized tests. ARTHUR E. TRAXLER is eminently qualified to tell how administrators can use test scores in making decisions.

The questions our authors raise are of no small moment. For what goes on in the small world of the classroom finds its way to the larger world outside, just as the events of the larger world are felt in the classroom. In our time we have had well-nigh unprecedented opportunities to observe the interplay between school and society. That interplay is the subject of MICHIOA SHIMBORI's report on education in postwar Japan.

THE SCHOOL REVIEW

Volume 68 Summer 1960 Number 2

ROALD F. CAMPBELL

University of Chicago

Financing Public Education in the Decade Ahead

By 1970 how much money is it going to take to support the nation's public schools and colleges? Where will the funds come from? To consider these questions, we must relate population projections, economic trends, and certain policy decisions yet to be made by the American people. We cannot approach these phenomena with equal confidence: extending population growth seems quite safe, projecting economic potential is less certain, and predicting policy decisions is downright hazardous. Even so, the need to see the total picture, distorted though it may be, suggests that an analysis be made.

The first task is to project the number of people the schools and colleges will serve during the 1960's. Our population continues to increase. Careful estimates indicate that now in 1960 we have 11.2 million in the 14 to 17 age group and may expect 15.9 million in

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1970; in the 18 to 21 age group we have 9.6 million now and may expect 14.6 million in 1970 (1). Other figures project an increase of 21 per cent in the 5 to 17 age group for the United States between 1957 and 1963 (2). It is clear that in the decade ahead we shall have substantially more children and youth to be served in schools than we had in the decade just ended.

Not only is our population growing in numbers, it is also changing drastically in occupational distribution. From 1900 to 1975 the proportion of professional workers will shift from 10 to 25 per cent of the total population, clerical and sales workers from 8 to 22 per cent, and skilled workers from 23 to 31 per cent. Over the same period service workers will increase from 9 to about 12 per cent, but laborers will decrease from 13 to 4 per cent, and farm workers from 38 to 5 per cent (2). The implication is clear: occupations that require training and education will continue to demand a larger and larger proportion of the population.

Let us turn now to trends in school and college enrolments. If we use the seven-year period from 1958 to 1965, enrolment projections are as follows: elementary school, from 30 million to 35 million, up 16 per cent; secondary school, from 9 and a half million to 13 and a quarter million, up 40 per cent; and college, 3 and a quarter million to 5 and three quarters million, up 76 per cent (2). It seems safe to suggest that by 1970 these per cents of increase in enrolment will be 20, 50, and 100, respectively. In round numbers this would give us the following enrolments: elementary, 36 million; secondary, 14 million; and college, 7.5 million.

There remains the task of calculating the dollar demands for the enrolments suggested. In 1958-59 our expenditures for public elementary and secondary schools amounted to 14.5 billion dollars and for public colleges and universities about 4 billion dollars, a total of 18.5 billion dollars. In terms of increased enrolments, with no change in quality of program, this would suggest expenditures of about a third more for elementary and secondary schools, or 19.3 billion dollars in 1970. For colleges, expenditures may easily double and reach

8 billion dollars by 1970. Thus the total projection for 1970 is 27.3 billion dollars.

But if we should attempt to improve the quality of education, still greater expenditures will be necessary. The Educational Policies Commission has made a case for the fact that current expenditures for elementary and secondary schools are but 60 per cent of the cost of a quality program (3). Moreover, if inflation continues, the dollar amounts will have to be stepped up even more. It would thus appear that an estimated yearly budget of 30 billion dollars for all public education a decade hence is a conservative figure.

Where will the money come from? The Research Division of the National Education Association has estimated that by 1970 our gross national product will be 630 billion dollars, based on a growth rate of 3 per cent; and 794 billion, based on a growth rate of 5 per cent (2). *Fortune* magazine projected a gross national product of 750 billion dollars for 1970 (4). Much the same picture was given in the 1960 *Economic Report of the President*, which reported a gross national product rate of 482 billion dollars for the last quarter of 1959 and indicated the possibility of an increase to 750 billion dollars by the end of the 1960's

At present, about 4 per cent of our gross national product is being expended for public schools and colleges. If by 1970 production of goods and services does rise to 750 billion dollars, a 4 per cent allocation for education would provide the 30 billion-dollar school and college budget. There is little question that the resources of the nation will be adequate to meet school needs. Whether tax arrangements for allocating local, state, and national revenues will be up to the task is another matter.

The Educational Policies Commission has studied the capacity of the states to support education in terms of income left to their people after disbursements for personal taxes and for basic necessities of food, clothing, and shelter (3). Residual income in 1955 averaged 5,984 dollars per school-age child in the eight highest states; 1,100

dollars per school-age child in the eight lowest states. The differential between the highest and the lowest states is almost five to one.

While high-income states might do more to provide additional state revenue for schools and colleges, many low income states, like Alabama, Georgia, Louisiana, and North Carolina, are already providing from state sources about 70 per cent of the revenue needed for public schools. The average for all the states is about 40 per cent. It will probably be impossible for low-income states to meet from state sources the increasing financial demands for schools and colleges during the 1960's.

At the local level, the property tax is virtually the only source of revenue. While assessment practices can be improved, there is no practical way by which school revenue from this source can be greatly increased.

Where does this leave us with respect to financial resources for the 1960's? In general, at the local level little expansion is possible. At the state level, only high-income states can do much to meet increased demands. It seems clear that much of the margin between present expenditures and our target of 30 billion dollars is going to require a plan of financing in which the federal government pays a substantial part.

If a sum of 30 billion dollars a year is to be spent for public schools and colleges and if a substantial part of this amount is to come from federal sources, obviously some policy decisions must be made by the American people. Before they can make these decisions, a number of myths will have to be dispelled. I am using the term *myth* to mean a way of thinking that has outlived its usefulness.

The first of these myths is that school policy-making is local in nature. To be sure, in this country we have a genuine measure of local control of education, but local boards of education have always worked within the framework of state and federal law. The state law—which includes the state constitution, statutes, court decisions, and administrative regulations—becomes readily apparent to him who

looks. The federal law is a little more difficult to detect, but for one who has dealt with vocational education or with the National Defense Education Act of 1958 the framework within which local boards must act becomes clear. Nor should we forget that the U.S. Supreme Court has made forty-five major decisions on public education.

Perhaps more significant than policy formalized by law are the political pressures on local boards of education. These pressures are exerted by many groups in our society, and nearly all of them hold membership in national networks. Influences may be exerted by the local chamber of commerce, a labor union, a citizens committee, a teachers association, a taxpayers association, all of which have state and national affiliations. To assume that the local board of education deals only with local problems is nonsense (5). In effect, formally as well as informally, many controls—state, national, and even international—are being exerted on our schools.

The second myth is that federal aid inevitably brings federal control. That some federal aid brings control is apparent. The National Defense Education Act, despite its pious language to the contrary, has many elements of control. Legislation that is designed to aid specific rather than general programs usually does have many controls. Ironically enough, those who lament federal control most seem to be the very people who would write the specifics into our bills.

While some of our federal legislation contains both explicit and implicit controls, we also have a long history of federal aid with few strings attached. In 1862 the Morrill Act provided for the establishment of land-grant colleges. For almost a century the federal government has shared in the financing of these institutions with a minimum of federal bureaucracy and a maximum of institutional discretion. Were we to substitute general aid for the National Defense Education Act, federal controls could be greatly reduced.

But I would not contend that no federal control is the ideal state of affairs. In my judgment the decisions of the federal courts on the segregation issue are in keeping with our democratic tradition and our basic law, and in reasonable time the states must conform. I do

object to the substitution of federal decisions for more enlightened decisions nearer the scene of action. I fear, for instance, that the guidance-institute program of the National Defense Education Act is defining the training program in guidance in ways that may be crippling. My own position is that it is far more useful to seek appropriate controls at the federal level than to continue to be frightened by the *bête noire* of control.

The third myth suggests that private goods and services are always to be preferred to public goods and services. Galbraith (6) has analyzed this bit of fiction more adequately than anyone I know. He develops the concept of social balance and shows that, when goods and services in the private realm are increased, goods and services in the public realm must also be increased. For instance, expanded production of automobiles in the private realm demands expanded provision for roads in the public realm. Or, when private production requires more scientists, engineers, and skilled workers, public facilities for the training of these people must also be expanded.

Galbraith challenges, too, our blind acceptance of production, regardless of what is produced, as the criterion of economic well-being. An affluent society cannot be content with the private production of pornographic literature and automobile fins, and insensitive to its school systems and police departments. Somehow the supremacy of private endeavor must give way to an appropriate balance of private and public endeavor.

The fourth myth is that education is a consumer good, not a producer good. Consumer goods are things we use and enjoy. I hope that education will always help individuals to think more clearly and to appreciate more deeply. To the extent that education succeeds in serving these purposes, it is a consumer good. Yet, it seems clear that, in a world of exploding knowledge, automation, and rocketry, trained brain power is our shortest commodity, a producer good *par excellence*.

Schultz (7) has examined this problem with some care. He contends that only about half of our economic growth has been coming

from increases in the labor force and in conventional capital. There seems to be a growing body of evidence that improvements in the quality of human resources account for much of our increased productivity. He thinks our schools and colleges have played a major role in helping to accumulate a stock of useful knowledge and this knowledge has, in turn, helped improve the quality of our human resources. May we recognize, then, that education is both a consumer good and a producer good. May we recognize, too, that as a producer good education contributes to the formation of human capital.

Assuming that in time the American people can dispel these myths, what policy decisions are necessary if an appropriate share of our resources is to be channeled to the support of schools and colleges? In bare outline these policy decisions would seem to include the following:

1. *That a substantial part of our wealth be used for the support of public schools and colleges.* Obviously, this part can be no less than 4 per cent of our gross national product. Our goal should probably be to double that per cent. This decision is necessary to help sustain the social balance between the private realm and the public realm, and it is also necessary for the formation of human capital.

2. *That all levels of government participate in financing public schools and colleges.* No longer can it be assumed that only states and localities have a stake in public education. The National Defense Education Act has made official what we have known for a long time: that education is vital to our national survival. For this reason, if for no other, the federal government cannot remain aloof. It seems entirely reasonable to expect the total cost of education to be divided about equally among federal, state, and local governments.

3. *That we make appropriate use of our major tax resources for schools and colleges.* At the local level the property tax will probably remain the chief source of school revenue. The sales tax should become even more significant as a source of state funds for education. Galbraith's (6) point that in an affluent society an expanded sales

tax is an admirable instrument of social balance is well taken. Through the personal and corporate income tax the federal government has a source of revenue that very quickly reflects the economic power of the nation. Already the federal government collects about 70 per cent of all taxes; it seems reasonable that a portion of this money should be used for the support of schools and colleges. The federal government has become the chief tax collector for the simple reason that the major part of our wealth can be reached by federal tax provisions more effectively than by local state tax programs. Clearly, tax revenues need to be tapped where they are and used where they are needed.

4. *That federal participation in financing schools and colleges be for general and not specific purposes.* Hysteria wrote many specific aid provisions into the National Defense Education Act. These specifics include funds for equipment to be used to improve instruction in science, mathematics, and foreign language; and fellowships for teachers who attend summer guidance institutes. But in reality we do not improve instruction in science and mathematics very much unless we improve the whole school program. Nor will we get very far with a cadre of well-reimbursed, partially trained guidance personnel as long as the teaching staff generally is underpaid or inadequate, or both. Ruml (8) has for some years recommended general aid to all states on a flat grant plan. The Murray-Metcalf bill gives expression to that idea. The Committee for Economic Development has, in its recent report (9), recommended federal aid for nineteen of our neediest states. Both proposals deserve more attention than they can be given here. Both plans call for general aid so as to take the federal government out of the business of exercising undue control.

5. *That operating decisions for schools and colleges be kept as near home as possible.* This position would permit us to retain basic legal responsibility for education and for the enforcement of minimum standards at the state level. Such a policy would also continue to delegate to local boards much responsibility for control of the actual operation of schools and colleges. At the same time, state and federal monies should be made available to these boards

of control to insure an educational program commensurate with the needs of a great nation. To be sure there will have to be some kind of accounting control over these funds, but the accounting should be an integral part of the regular accounting procedure and not a special invention of the Bureau of the Budget in Washington.

At this point it seems appropriate to ask how we move toward the goals suggested. There is no magic formula. It does seem clear that policy-making is a political process. Far-reaching policy—the kind of which we have been speaking—is formalized by state legislatures and by Congress. But we cannot concentrate on that formalization only. Perhaps we need to understand more clearly than we do the nature of the influences that are brought to bear on law-making bodies. It is at the level of policy formulation, not policy enactment, that work needs to be done.

There is a power structure operating at state and national levels just as there one operating at the local level. Mills, who has analyzed what he calls the power elite, finds an alliance of business, military, and political leaders (10). Hunter has also given attention to the national power structure (11). He concludes:

The nation's power system is a series of interlaced and coordinated power structures. Those at the apexes of power in communities, states, regions, service organizations, and industrial complexes become generally known to each other. Some of the leaders in the larger units of power become symbolic power figures in the nation [11:191].

In this connection it is significant to note that T. V. Hauser of the Committee for Economic Development, upon the release of the Committee's report to the press, said that the CED would not undertake a program to sell its ideas on school aid, but he added, "This report will reach people who are in a position to act, and the degree of action will depend on how much sense it makes to them" (12).

In the end the case for adequate financing of education must be made by influential lay leaders. Note what Lister Hill has done in Congress for hospitals and public health. In one session of Congress,

despite administration opposition, more than twenty "Hill bills" affecting the public of the nation were enacted into law (13). In Hill we have a man with a deep sense of commitment to public well-being, with scrupulous personal integrity, but a politician who knows his trade. We must find, I think, some Lister Hills for education.

Does all this talk about politics and lay leaders mean that the education profession can do nothing? While I think policy decisions for education are essentially lay decisions, I am convinced that the profession can and must influence these decisions. First of all the profession needs to keep everlastingly at the business of marshalling facts. In this regard the Committee on Educational Finance and the Educational Policies Commission of the National Education Association are to be commended. However, the profession might do more to make common cause with other scholars. We have, for instance, thoroughly competent economists who are vigorous inquirers and exponents of ideas. They cannot easily be accused of pleading special cause. We need to test our ideas against their scholarship.

All of us must know something about the relationship between economic well-being and the provision for adequate schools and colleges generally. Only with such understanding, I suggest, can we exert any influence on the power figures in our own communities. And as we know, the power figures at the state and national levels live in local communities. Ours are not the only voices these lay leaders will give ear to, but they will hear more when we have more to say. As professionals we can give information, suggest consequences, and take a position on how to meet defensible needs in school finance.

I have suggested that within a decade we shall have money demands for public schools and colleges of no less than 30 billion dollars; the anticipated economic resources for the country as a whole are adequate to the demand. I have also suggested that certain myths about expenditures for education need to be dispelled; that a partnership of local, state, and federal governments should be formed to finance education; that the implementation of this policy will be

achieved through the political process in which lay leaders carry the ball. Finally I have suggested that an enlightened profession can influence laymen in general and lay leaders in particular, but the ideas of the profession must, in the end, be winnowed in the net of the commonweal. I think we would have it no other way.

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HERBERT A. THELEN

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Education and the Human Quest: What's To Become of Johnny?

*In which
we let Johnny show us the richness
and the complexity of human behavior;
note the fundamental conflict between
our animal and our social nature;
and propose that life is a continual
natural inquiry into ways of resolving
the conflict in each of its confrontations;*

*we suggest that the task of education
is to supervise this natural inquiry
and make it educative;
and we identify as most crucial a phase
of the learning process that is generally
ignored or seriously bungled in schools.*

All sorts of people go to school: toddlers, tomboys, thirsters; squirmers, dreamers, thinkers; men, women, and widows; adolescents, housewives, teachers; and persons who just want to learn to tie flies for the fun of it. Teachers are of all sorts, too: they range from nimble piccolos to thumping basses, from mellow horns to clashing cymbals; from sparkling champagne to flat beer; from lovable lizzies to champing Cadillacs. And lessons are learned in all sorts of places. Formal education goes on in bungalow-type schools, in glass and

HERBERT A. THELEN is a professor of education at the University of Chicago. We are presenting here with minor changes chapter 2 of his book *Education and the Human Quest*, to be published by Harper and Brothers in the fall of 1960. The chapter is preprinted with the permission of the publisher. Interpretive drawings by ROBERT ERICKSON of the Laboratory School of the University of Chicago.

steel factory-type buildings, in rustic redwood and vine-covered retreats and in penitentiary Gothic monuments. Informal schooling goes on on street corners and in street cars; in churches and carousels; playgrounds and police stations; museums and mausoleums. Need I continue?

I have named only a few of the countless influences that help explain what happens in a particular educational situation. To a wide assortment of pupils, teachers, and settings, we could add a wide assortment of subject matter, resources, groups, and community attitudes. The variety of educational situations is endless. If you combine only the categories of pupils, teachers, and settings listed more or less facetiously in the opening paragraph, you get 416 combinations, and each of these will have its own distinctive flavor.

In short, every educational situation is unique. Every classroom group writes its own history, has its own failures and successes, its own *mélange* of the animal, the vegetable, and the spiritual. To compound the complexity, the experience of each pupil in the classroom is in some ways different from that of every other pupil. The same classroom may, for different pupils, be deadly, exciting, boring, challenging, important, stupid, fearful, ego-building.

To discover the basic nature of the educative process we must dig beneath all these complexities. But even this resounding topic can be broken down into three kinds of ideas—ideas about the nature of man, the nature of knowledge, and the nature of society. For it is the interaction among these natures in each educational situation that constitutes the educative process.

To think about anything as grand and gaudy as human nature requires a plan. How shall we inquire into human nature? How shall we identify those aspects of human nature that will lead us most directly to an understanding of the processes of education?

Generally speaking, four approaches are open to us. First, we can ask experts—sociologists, psychologists, anthropologists, theologians, lawyers, and others who are concerned with the nature of human beings. Certainly the ideas of specialists would be useful—if we

could see their relevance to questions in education. Second, we can observe the behavior of human beings engaged in learning and try to come up with insights that directly expose the educative process. Third, we can visit a great many classrooms and try to synthesize or select a model of education that we think would be most valid and most useful for the creation of other educational experiences. Fourth, we can harken to our own intuitive feelings about our own educational experiences, for we all have more wisdom than we are aware of.

Each of these approaches is useful: the scientists can sharpen our sensitivities and help us formulate significant questions; observation of human learning is necessary to link behavior to principles; classroom models represent practical wisdom expressed in the vocabulary of action; and our intuitive feelings of what is important and what makes sense will help guide any approach we take.

Having paid my respects to the available fountains of wisdom, I shall proceed to get a slice of behavior before us so we will have something to talk about. I shall try to choose an incident that has universality, an incident that could be part of anyone's life. I also want as little interference as possible from such artifacts as laws, deadlines, or other imposed requirements. In short, we seek a slice of natural behavior—a slice in which we can see inherent tendencies of human beings.

Consider a child. Let's make him a four-year-old and have him take a walk in the park. On the way he sees a building, and he says: "What's that?" We say, "That's a garage." And he says, "What's it doing?" We see that the four-year-old already has a well-developed system of word logic which tells him that an object must have a function, must be able to do something. When you name something, he wants to know what it is doing. "Is the clock going?" "Yes." "Where?"

He starts down the sidewalk, and we notice that he walks slowly, stops, then walks fast; and he also weaves from side to side. What accounts for this odd locomotion? We notice that when he stops,

his eyes focus on something: he gives his attention to something. Now he picks up a rock and drifts off into what seems to be a bit of a daydream; he seems oblivious to his surroundings; he mutters to himself. Then he puts the rock into his pocket and moves on. He seems to forget the rock: he is looking at other things. But pretty soon he takes the rock out of his pocket and drops it on the ground; a look of annoyance or frustration crosses his face; and shortly afterward he kicks a tin can.

Let's try to see what is going on in this situation. First of all, Johnny goes into the park, not as a blank slate, not as a vacuum; he goes in with certain anticipations that he probably cannot put into words. He may be expecting adventure or challenge. And he has feelings about his anticipations—feelings of eagerness, of delight, of—well, heaven knows what. Relief at getting away from Mother? At getting out of the house?

He wanders back and forth, and he runs and he walks. Why? Because he is a human organism and eats food. There are only three things you can do with food. You can build body structure with it, a step often followed by buying scales for the bathroom; you can translate it into motion; or you can get rid of it, having taken what you can. This boy has a need for activity; he cannot help it; he simply has to be in motion.

The process of giving attention is an interaction between the child and the objects he looks at. The stone he picked up must have a good deal of meaning for him—or at least more meaning than other objects he might have picked up and been attentive to. This attention is probably accompanied by a procession of thoughts, though it is possible that he cannot put the thoughts into words. Let's consider what the stone might mean to Johnny, what might have caused him to give it attention.

First, he might see it as a weapon. He might have seen a rock thrown through a window recently. He might have heard the story about David and Goliath. Or was the weapon in that story a pea-shooter? Johnny might have a slingshot of his own—or he might





wish he had one. If these are Johnny's thoughts, the rock is linked with aggressive impulses; one of his feelings at a subliminal level may be that the rock might make a good weapon.

A second possibility is that the rock is pretty. Because it is pretty, he thinks that somebody might covet it. He could hide it in the goldfish bowl. His fish might like to have it there. Or he could use it for barter.

Another possibility—and who knows what goes on in the mind of a child—is that the rock is a talisman; all he has to do is to rub it in the right way, and he can float off into space. That would be an escape reaction.

Still another possibility is that somehow this stone is connected with Mother. I don't know how, but with little kids sooner or later almost everything gets connected with Mother. Maybe Mother has a rock collection, or maybe she hates rock collections. It doesn't really matter. In either case, some of his emotional investment would come from his perception of Mother's attitude toward rocks.

These are some of the thoughts that may flow through Johnny's mind as he picks up the rock. Johnny is under no great pressure to put his thoughts into words; but as the thoughts come, he savors them and the new patterns they form. The ideas make the stone meaningful to him; it is thus invested with positive value, and he puts the treasured object into his pocket.

Now he becomes uneasy. He is ambivalent. He becomes aware of his feelings about the whole situation—a situation that became real the moment he decided to keep the rock. Maybe he shouldn't put it in his pocket and take it home.

Let's assume that Johnny's mother is getting awfully tired of sweeping trash out of the house. After taking six lizards, three old playing cards, and a bottle cap (rusty) out of Johnny's pocket, she probably said something about not bringing trash home. Johnny becomes aware that his first impulse to take the stone home—because it has value to him—is being tempered by recollections of other people who will be involved. That is, he is becoming aware of a larger social context of his act. Interpersonal feelings are mixed

into the situation. You'd think that picking up a rock and taking it home wouldn't be an interpersonal situation, but it certainly is if you have a mother like Johnny's.

He becomes aware in some vague way that all is not well. If he takes the rock home, he may suffer deprivation of his mother's love—or whatever loss he feels in Mother's anger at having trash around. If he is a fortunate child, he is able to interpret Mother's anger as anger at trash. But if he is like the typical child of many homes, he interprets Mother's anger at trash as being directed at him in some subtle way. He must make a choice now, to keep the stone or to throw it away. But this is not just a choice about a stone; to him it is a choice about a kind of belongingness. How important is the stone compared to Mother's love?

He decides to throw away the stone—something that for the brief space of a few minutes was meaningful to him, something that in his fantasy was a jewel. He has flung away this precious bit and his daydreams with it. So he feels deprived. He has to do something with his feelings, which have translated themselves into anger. So he kicks the can.

With Johnny's help I have tried to show the richness and the fulness of individual behavior. My account goes far beyond simple objective description. I have speculated freely. Many of my speculations would be difficult to prove. I hold no brief for the accuracy of any details of my story. But I do allege that the sorts of processes I described do go on.

Humans beings do act; they have ideas and feelings; their memories are jogged by cues in the environment; they do make decisions—or appear to make decisions; they change their minds on the basis of second thoughts; they react to their own ideas and feelings, and to their reactions to their ideas and feelings; they do have awareness of past experiences and of future consequences; they do have relationships to other people and feelings about these relationships; they live in their own worlds which, while close to objective reality in some ways, also contain distortions, dreams, hopes, and expecta-

tions; their desires are influenced by wants from within and fears or demands they perceive from without; they are aware of some of their behavior and may even consciously hold theories about it; at the same time they are unaware of much other behavior; and everything they do has a lifetime of history behind it.

These statements are glib textbook generalizations. They are useful to sensitize us to what to look for, to call attention to possible motives and meanings of behavior. The generalizations mean nothing of themselves; but they mean a great deal when we use them to help answer the questions: How does Johnny behave? Why does he behave as he does? But note what we assume in these questions: that Johnny's behavior is purposeful, that the whole sequence of behavior we watched has unity or coherence; and that this unity cannot be understood apart from Johnny's own needs, interests, experiences, ideas, and feelings.

A great deal becomes clear when we note that Johnny acts as if he were caught in a tug of war between his spontaneous desires and his mother's anticipated displeasure. Such a notion might help explain Johnny's behavior in many other situations as well, for it suggests a conflict imbedded in a long-standing and continuing relationship between Johnny and his mother.

Diagnosing the theme, however, is but half the task of understanding Johnny. The other half is empathizing with Johnny's feelings or mood. How does he react to the conflict within himself? Does he become angry, bored, delighted, apprehensive, affectionate, or withdrawn? The expression of a mood involves all of Johnny. It is not merely Johnny's brain that gets angry: his fists clench, his neck flushes, his speech becomes incoherent, his features contort, his feet twitch. A dog would detect that Johnny even smells different when he is angry.

Thus to understand behavior we must be able to answer two questions. First, what is its theme, its purpose, its problem-to-be-solved? Second, how does the individual respond to this theme emotionally?

Our lives represent the interplay of themes that come out into

the open in certain situations and then, like a spent melody, retreat into the background as other figures achieve prominence. In each reappearance, a theme has a new configuration, a new flavor, a new way of functioning. It may find direct expression in conscious seeking; it may be projected as if it belonged to someone else; it may provide an undercurrent of almost-felt meaning; it may suddenly unleash a new insight or discovery.

At root, human experience is dramatic. The basic themes are themes of conflict—conflict between our wishes and the wishes of others, between our present needs and our future capabilities, between our animal nature and our social ethics, between what we are and what we want to be, between our easy habits and our creative urges.

It is unfortunate that the word *conflict* has become a dirty word, for our emotional reactions to the term blind us to the fact that without conflict neither growth nor education would be possible. In our Organization-Man society we tend to assume that conflict is all bad and destructive, not realizing that it is ridiculous to think of a universal fact as anything but a universal fact. It is true that we may deal with conflict in ways that are stultifying and destructive; but we may also deal with conflict in ways that lead to individual enlightenment and social cohesion. Man has both capabilities, and the task of education is to enable man to develop the constructive capability to the full.

Human nature contains a basic conflict between two ways of dealing with stresses inevitable to life. The first way of dealing with stress can be traced to our animal origins. According to La Barre (1) this way is automatic and reflective. Sensing danger (if one is an animal), one attacks, runs, or freezes. Given powerful claws, fleet feet, or protective coloration, one can survive. But man does not have these special bodily features, so for him outright attack or flight is mostly futile. His reflexive behaviors are muted; he lashes out with biting words, changes the subject or daydreams, or merely flushes beet red.

The development of families added another reflex to fight, flight,

and immobilization. This way is through dependency, and it has its clearest appropriateness for the survival of the young: sensing danger, one runs to Mother (and the family as a whole turns to Father). In adult human beings we see this reflex in irrational impulses to look up the record, to get the boss to repeat the instructions, to find out what "they" want to do.

With the development of society and the requirement that the young adult go outside the family to find his mate, still another kind of reflex developed: seeking intimacy with another, as, for example, in gossip sessions.

None of these impulses is bad unless it is simply acted out without any understanding of what one is doing. In this case one acts without responsibility: one surrenders the ego functions, which make man free, to the conditioned or inherited animal reflex.

The second way of dealing with stress, or conflict, is through inquiry. This is the way of insight, of learning, of consciousness of methods, of diagnosis, speculation, hypothesis-testing. This capability probably began with the use of tools, which required the ability to distinguish between self and object, organism and environment, cause and effect. Such distinctions require consciousness, language, and the ability to learn from one's own and others' experiences. This way tries to deal with stress through reflection on the situation, which includes oneself as actor. It involves discipline and the ability to curb tendencies to act out, the ability to live with tension and challenge long enough to formulate a plan.

The method of inquiry is learned, and the long period of human infantilism and family protection—as well as formal education provided by the community—is designed to develop Johnny's natural quest into an educated inquiry. Educated inquiry is a social development stimulated by the interaction of man with man. It is the central capability of man as a member of society (2, 3).

Both the animal and the societal capabilities exist and blend in human nature. If either takes over too strongly, we get into trouble. Acting out does not change a situation for the better, nor does one learn anything from acting out. Yet the spontaneous expression of

impulse, which is the beginning of acting out, is required to enable us to diagnose a situation. For we understand situations by seeing not only what thoughts we have but also what feelings and inclinations we have. The awareness of anger tells me something, not about me alone or the situation alone, but about the interaction between me and the situation. This awareness yields important information to be interpreted through inquiry. The destructive possibilities of acting out should not be confused with the constructive need to obtain knowledge about our involvements, conflicts, and commitments. To subdue the beast within, we must learn to accept the fact that we have a wide array of impulses of all sorts. We must learn non-destructive ways of expressing our impulses sufficiently that we can become aware of them. And we must learn to interpret their existence as the source of non-rational intelligence about ourselves and the world.

But inquiry, too, can be distorted and become an end in itself rather than part of a constructive way of life. When we limit the data of inquiry to objective facts, denying the existence of individual meanings and reactions, and when we confine the process of inquiry to the solution of puzzles already put into words by someone else, then we are being rational but not intelligent. When rationality runs amok without continuing or at least frequent contact with mood and feeling, it leads to fantasies. Some of these fantasies, like the Nazi plan for a totalitarian state, are highly rational; but they also flay human nature and carry within them the seeds of their own *Götterdämmerung*. Inquiry is meaningful and constructive only when it takes individual intuitions and emotional response into account; and emotional expression (except in such consummatory expressions as music and dancing) is constructively creative only when it provides data for inquiry (4).

As we again look at Johnny we begin to see part of the educational task; for we realize that his experience in the park is not, by itself, educative. I have great sympathy for Johnny, but I would like to be aware of his thoughts and feelings. I am sorry he solved

his problem by throwing away the rock, just as I am sorry whenever anyone deprives himself of something of value to himself without testing to see whether the deprivation is necessary. I would like Johnny to have taken the rock home and shown it to his mother; and I would like her to have responded with interest—not in the rock perhaps, but certainly in Johnny's ideas about the rock. After that, there would be plenty of time for the two of them to decide together what to do with the rock.

I would also like Johnny to be able to laugh at the spectacle of himself kicking the tin can, to accept the fact that he feels better for having done so, but also to know that he was angry, that it is all right to be angry, and that while he has, perhaps, gotten rid of some of his anger he has in no way changed the situation or bettered the relationship which he thinks exists between himself and his mother. I would like Johnny to know—through discussion now and through reading when he is older—that other people get angry too and that there are many different ways of dealing with anger. And, further, that a rock collection can pose many intriguing questions that open doors to the big wide world. In short, I would like Johnny to have the equipment and the guidance he needs for finding some of the many meanings the experience had for him and might have for others in similar situations.

Such learnings as these distinguish between natural and educative experience.

Consider the old chestnut: Johnny can shell eighteen walnuts in three minutes, and Harry can shell forty-two walnuts in four minutes. How long would it take the two of them to lay bare the meat of 101 walnuts? This is a problem.

Or take all the thousands of problems at the back of all the millions of algebra books; take all the tons of workbooks that keep the more docile children quiet while the teacher works with a committee; or take all the clever "aids" designed to make education a lock step through a prepackaged curriculum (in the name of "de-

mocracy" or, possibly, of bad economics). All these exercises provide opportunity for the child to be reasonable, to apply information in the way any reasonable child would. In all these exercises, the number of answers possible is implied in the way the problem is stated—and this is true even for intelligence tests. After all, there are only a limited number of ways you can go wrong in applying logical processes to a word problem. While some children are more ingenious than others in finding wrong ways, the possibilities are strongly limited by the way the problem is stated. When we are confronted with a serious perplexity, our problem is 90 per cent solved when we hit on the "right" or key question. The right question is the question that makes available to us a large amount of explicit information and judgment.

It is in the formulation of the problem that individuality is expressed, that creativity is stimulated, and that nuances and subtleties are discovered. It is these aspects of inquiry that give birth to new social movements and political orientations, and that are central in the emergence of insight. Yet it is precisely these aspects of inquiry that schools ignore, for they collapse inquiry to mere problem-solving, and they keep the student busy finding "solutions" to "problems" that are already formulated, externalized, depersonalized, and emotionally fumigated. The school is concerned with the student who formulates his own problems only when he is so creative with school property that he perforce enters a "counseling" relationship (on pain of dismissal). But as far as the academic work of the school goes, personal stirrings and strivings and self-discoveries have no place. In effect, what is missing is the investment of learning with personal emotion and meaning.

The part of inquiry that gives birth to creative awareness of problems is closely linked to character; to personal commitments, causes, and goals; to temperament; to basic orientation to the world. These aspects of personality comprise the individual's fundamental psychic equipment, and this psychic equipment largely determines the goals and the quality of experience one seeks. The child's char-

acter develops through the experience of inquiry; but it does not develop through problem-solving alone. For problem-solving is a technical enterprise, and it is amoral.

As I see it, then, what has happened is that, in line with the technical temper of the times, we have ground out students who can solve problems but who will forever have to be guided by someone else (5). We have turned out people who can, for the most part, be replaced by machines in modern industry and, in fact, are rapidly being so replaced. The present hue and cry for leaders and creative geniuses is really a cry for people who can think as whole people, with commitment, emotional response, sensitivity, self-awareness, and self-knowledge. These capabilities are firmly "conditioned" out of many children by the time they are four years old; but in the life of inquiry these capabilities know no ceiling. In short, the emphasis on education as a process that begins only with someone else's statement of the problem denies the most fundamental human need: the quest for autonomy.

Our leading educators are clearly asking for development of the autonomous man (6). They place highest priority on the "intelligence principle" (Clarence H. Faust); "freedom and discipline" (William H. Cornog); "understanding and ability to apply principles" (Ralph W. Tyler); "self-motivated inquiry" (Francis S. Chase); "proper relationships between values, attitudes, knowledge, skills, and overt actions" (Robert S. Gilchrist); "ability to deal with practical and persistent problems" (Lloyd S. Michael); "education to fit the goals of each student" (Kenneth W. Lund); and "self-direction" (Howard A. Latta).

Let's look back at Johnny. He has left the park; he is entering school. What will his experience be? Will anyone answer his question: "What's that?" Will he be free, even, to ask the question? Will he be able to walk slowly, rapidly, from side to side? Will he discover any rocks, precious in his eyes and capable of absorbing all his attention? Who will see to it that rocks are there to be found?

How will Johnny decide what to keep and what to cast aside? What advice will he get? Will he ever experience the thrill of mastering anything? How often will he encounter a day of challenge or adventure? Will inquiry become part of his way of life, enriching and ennobling it? What kind of man will Johnny, the boy, be father to?

First grade, second grade, third grade . . . intermediate grades, junior high, high school . . . fall, winter, spring . . . days, weeks, months, years . . . to what end?

Johnny has entered school.

What is to become of Johnny?

NOTES

1. Weston La Barre, *The Human Animal* (Chicago: University of Chicago Press, 1954), p. 371.

2. W. R. Bion, "Experiences in Groups, I-VII," *Human Relations*, I (1948), 314-20, 487-96; II (1949), 13-22, 295-304; III (1950), 3-14, 375-402; IV (1951), 221-28.

3. Dorothy Stock and Herbert A. Thelen, *Emotional Dynamics and Group Culture* (New York: New York University Press, 1958), p. 296. Five years of experimental research with Bion's concepts are reported in this book.

4. For a description of the basic dilemma of acting out as opposed to inquiry, see Herbert A. Thelen, "Emotionality and Work in Groups," in *The State of the Social Sciences*, ed. Leonard White (Chicago: University of Chicago Press, 1956), pp. 184-200.

5. Herbert A. Thelen, "The Triumph of 'Achievement' over Inquiry in Education," *Elementary School Journal*, LX (January, 1960), 190-97.

6. Francis S. Chase and Harold A. Anderson (eds.), *The High School in a New Era* (Chicago: University of Chicago Press, 1958). See chapters by the educators named.

Spontaneous Schooling and Success in Teaching

Investigators who have studied the chaotic literature on teacher effectiveness have occasionally lamented the lack of a coherent theory in the field (1). Such a theory, however tentative, might provide a framework for discussion and lead to new lines of research. In the hope of serving these purposes, we would like to consider a general psychological theory of schooling. We want to try to show how this theory, which covers the whole general phenomenon of schooling, leads to a number of deductions regarding success in teaching. The theory is concerned with the traditional teaching process as it has functioned in primitive and civilized societies from prehistoric times to the present. It may not fully apply to the more mechanized and elaborate teaching process that some people envisage for the future.

The general theory is that of spontaneous schooling (2). Starting with the traditional sociological function of the school, this theory attempts to describe the psychological forces responsible for the existence of schools or schooling, and the basic psychological mechanisms by which the school works.

Naturally enough, the sociological function of the school is closely related to the role of the school in the survival of the species or group. To have a good chance of survival, members of a group must attain reasonable proficiency in many kinds of behavior. Typically, these ways of behaving, or tendencies, call for nurture or cultivation. It follows, then, that a group is more likely to survive if it has mechanisms for the cultivation of these tendencies.

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Some essential tendencies, like breathing or swallowing, have immediate survival value. These tendencies are developed by practically foolproof mechanisms in which nurture plays little part. Other tendencies, like those involved in eating reasonably nutritious foods, are also important to survival but they permit some latitude and can be developed by a more haphazard system. Typically they are nurtured by parents, who have automatic, built-in concerns. Finally, there are scores of frivolous, playful, or decorative tendencies that for years contribute nothing immediately to survival but, on rare occasions, have made tremendous contributions to the survival of the group. For instance, the tendency to make marks on rocks probably had little or no direct influence on the survival of the group. As part of the basis for written communication, however, these tendencies could make an enormous contribution to survival.

As the species evolved, tendencies that had remote or questionable value failed to elicit from parents the immediate, urgent, day-by-day concern that was shown for eating or dressing. Typically the school has evolved as an agency that has shown as much urgent, day-by-day concern for writing and tribal legends as the home has shown for the more vital areas of talking and eating. Of course, the school has cherished the academic or decorative activities for their intrinsic worth, not for their highly questionable contribution to survival in some remote future.

Such, then, is the school's basic role in aiding survival. What forces led the school to assume and fulfil this role? In answering this question we are reluctant to invoke any great measure of human insight or to rely heavily on deliberate rational decisions. On the contrary, our theory assumes that schooling would be much more likely to exist and to flourish if the forces responsible for it, like those responsible for biological procreation, were deep-rooted and primitive and capable of operating in the absence of any great amount of insight or intelligence. Our theory holds that such beneficent automatic forces do exist and that they reside in a vast number of widespread, powerful, primitive tendencies.

These forces or tendencies can be classified into two groups. In one group we find tendencies that result in playful, manipulative behavior that has little immediate survival value. One thinks of such activities as making marks in the sand, dropping rocks in pools, playing with echoes, or hitting balls with sticks. In another group we find extremely powerful but unpremeditated tendencies to communicate. In spontaneous, unthinking fashion we find ourselves telling others of our interests or experiences. Quite spontaneously we react to the way others behave in matters that interest us. Our reaction may consist of spontaneous applause, an ill-concealed shudder, an overt correction, or a compulsion to supply the solution or the word for which someone else is groping.

The tendencies responsible for behavior that has little immediate survival value are widespread and powerful. So are the primitive tendencies to communicate. The tendencies in both groups often function without the aid of elaborate rational decisions. Indeed they often function when rational decisions say, "No."

These tendencies, which are present in all individuals, are especially strong in some of us. People thus plentifully endowed are likely to find children the most convenient audience for their communications. From the combination of these forces and circumstances, schools of some sort are almost bound to result, whether or not the community or the people involved have given any thought to the desirability of such institutions.

We now have schools blindly established and geared primarily to the task of developing traits that have remote and questionable value for survival. By what basic mechanisms does the school perform this task? To influence pupils, the school must have at its disposal certain forces or mechanisms that are capable of engaging whatever mechanisms of learning may be found in the child. Our theory holds that the spontaneous tendencies that give rise to the school in the first place are the same tendencies, now operating in the service of the schools, that engage those mechanisms of learning found in the pupil.

This neat gearing is not surprising, since the spontaneous tendencies and the mechanisms of learning probably evolved hand in hand.

Whatever the evolutionary link, the spontaneous tendencies are bound to engage the mechanisms of learning. An adult with a strong interest in, say, algebra, and with a liberal supply of the communicative tendencies, will automatically induce children to respond to some of the notions in algebra, will reinforce or accept proper responses, will correct erroneous responses, will point the way to the right answers, and will sharpen the pupil's insight into the relations between procedures and outcomes. In these events we find a composite list of the mechanisms of learning stressed in one theory or another. Because of his spontaneous tendencies, the adult effectively engages those mechanisms and does so whether or not he has any intention to teach.

In stressing the power of these blind, primitive tendencies, we want to avoid giving the impression that the forces are all-sufficient, or irreplaceable, or that the teacher has any obligation to rely chiefly on these tendencies. It would be surprising if the schooling induced by these forces could not be augmented by intelligent deliberate efforts. It is possible, indeed, that the contribution of new techniques might completely dwarf the growth induced by these primitive forces. Certainly the existence of such primitive forces in no way imposes an obligation on the teacher to cultivate them or to emphasize them.

We are concerned here with the limited claim that powerful primitive forces do exist, that they probably do operate in modern teaching, and that they do induce considerable growth. With that claim in mind we consider this question: What qualities should teachers possess to achieve whatever might be achieved through the operation of the primitive forces?

If a student is to become proficient in history, algebra, or reading, he must encounter these subjects and be led to make some reaction to them. To bring about these results, the teacher should have some knowledge of the subject he teaches and the willingness, preferably

the urge, to entertain the basic ideas in the subject. It is true, of course, that teachers who are lacking in knowledge of their subject can still arrange for necessary stimulation by using other resources or by various indirect means. This ability to invoke sources beyond the teacher's own knowledge can at times be most important, especially in advanced work or in stimulating children, at any level, to engage in special interests. For most teaching, however, these outside sources are not considered a dependable substitute for the teacher's knowledge of subject matter.

Little will be said here about just how much the teacher should know about his subject. For day-in and day-out teaching, it would seem helpful if he knew as much as his best pupil is likely to learn, and prudence calls for a comfortable margin beyond this. But as far as stimulation is concerned, we cannot hold that the more knowledge the better, and certainly we cannot expect a neat linear relation between knowledge of subject and skill in teaching.

Along with his knowledge and a personal interest in his subject, the teacher must have the willingness, preferably the compulsion, to talk to others about his subject. It is not at all necessary that the communication be undertaken for altruistic purposes. Indeed we would expect more dependable teaching from the person who, in talking about his subject, was driven by the compulsion the traveler feels to tell of his journeys or the urge of the parent to talk to all and sundry about the doings of his child. It is somewhat ironic that the terms we use to describe the successful teacher come perilously close to describing the bore.

Students often use trial-and-error procedures. That is, they react to an idea, a situation, or a problem several times before they hit on an acceptable response. If the trial-and-error procedure is to be effective, the teacher must be willing to keep an idea or situation or problem before the students long enough to permit a series of responses. He should not merely mention one idea and rush on to another one while the students are frantically reacting to the first. He

must linger, preferably, of course, in a dignified manner. A lecturer, for instance, may hold an idea before an audience by repeating it in slightly different form, stating it now one way and now another, each statement being designed to elicit a new reaction.

The willingness to dwell on simple ideas may spring largely from ordinary patience. But it is not entirely a matter of patience. As conceived here, the willingness to linger over elementary ideas does not necessarily imply kindness or gentleness or consideration for the hesitant steps of the learner. It may come from sheer repetitiveness or slowness or love of one's own words. The willingness to linger is the important thing. The underlying motive is not specified.

Willingness to linger over ideas does not always go hand in hand with exceptional scholarship. The accomplished scholar may be reluctant to keep an idea, particularly an elementary idea, before his students. The elementary idea has no appeal to him as an idea. He is on the trail of a much more intriguing, more subtle, more complex idea just around the corner. It may go exceedingly hard with him to dwell on a seemingly elementary concept when he has something really important to say. This is one consideration that makes us unwilling to predict a one-to-one relationship between knowledge of subject and skill in teaching.

The teacher must motivate, stimulate, or set ideas in motion. He must also reinforce. As we have noted, he must accept some reactions that his pupils make to the ideas he sets forth. Other reactions he must not accept. What qualities must the teacher have to master this differential reinforcement?

To a certain extent, the qualities needed for applying reinforcement duplicate those needed for effective stimulation. If the teacher is to know which ideas to accept and which to reject, for instance, he must know his subject. Indeed, the mastery required for reinforcement is probably much greater than the mastery required for the original presentation. Preparation for the presentation can be made in advance with the help of textbook and references. No facile and

wide-ranging mastery is called for. Reinforcement, however, cannot be anticipated. The teacher must react to the student's responses as he makes them, guided by information on tap at the moment.

Preferably the teacher's knowledge of subject matter should be so ingrained that it controls the many automatic reinforcements that continually come from the subtle changes of expression on the teacher's face. As the pupil's statements hit home, the teacher's face shows pleasure or relief; as the pupil strays into more questionable territory, the teacher looks puzzled, uncomprehending, or hurt. These subtle changes spring automatically to the teacher's countenance. They are seldom deliberate. But they will come only if the teacher has a fairly rich background of information so clearly in mind that the pupil's statements elicit inevitable reactions.

These automatic expressions provide some measure of reinforcement whether the teacher intends them to or not. But they are not enough. The teacher must be willing, or preferably compelled, to apply overt reinforcement as well.

This willingness to apply reinforcement comes most readily from the person who is uncomfortable in the presence of error. When he hears a mistake, he is impelled to correct. He corrects the grammatical slip. He contests the seeming error of fact. He comments on the clumsy management of an instrument. The compulsion to correct may function even in the face of a resolve to remain silent. Reinforcement that springs from such compulsion is likely to be inevitable and prompt. In contrast, the reinforcement that arises chiefly from a deliberate resolve or a sense of obligation may suffer the fate of other good intentions—postponement or neglect.

Spontaneous, non-altruistic tendencies to commend or correct are widespread in the human race, especially, perhaps, the tendency to correct. In the margin of books no one else will ever read, we pen comments to authors already dead. Teachers correct spelling errors in examination books that are not to be returned. This characteristic, like some mentioned earlier, has unflattering implications that will be discussed later.

In much of the reinforcement applied in the classroom there is

a strong component of social approval, either implied or overt. To be sure that such reinforcement has an effect, the teacher should be the kind of person whose approval or disapproval counts with pupils.

To say that a teacher must count with pupils, or be taken seriously by them, is not to say that he must also impress adults. It is possible for a teacher to be quite a personage to his pupils and yet be written off as a nonentity by parents, supervisors, or other adults. Conversely, a person who impresses adults may have little impact on the pupils. In the case of such disparity, it is the impact on the pupils that should be stressed.

There are many ways in which a teacher can be taken seriously. He can be loved. He can be admired. He can be feared. He can be seen as a symbol of some agency that is taken seriously. But by one means or another he should count. He should not be disregarded.

If the teacher is to be effective, the spontaneous urge to speak of what he knows must lead him not only to stimulate and to reinforce but also to guide the student to the correct answer. This tendency to guide others to a correct response is widespread and resides in a simple and automatic compulsion. It is seen in the almost irresistible urge of the audience to supply the correct answer for which the quiz contestant is groping. It is seen in the frantic hand-waving by which pupils signal their eagerness to provide the answer that eludes their classmate. It is seen in the unintentional rhetorical question which we promptly answer ourselves. The good teacher must share this urge. True, at times he will strive firmly to suppress it, standing by with forced patience while a pupil clumsily works out the answer for himself. But the urge should be there, even though it should not always be indulged.

In many views of learning not only is it necessary for the teacher to stimulate, to reinforce, and to provide guidance; it is also necessary for the pupil to acquire some degree of insight. The pupil must see the relation between a given act and the consequences of the act. He must see that "doing this leads to that." In some views of learning the attainment of such insight actually constitutes learning.

To help students attain this kind of insight, the teacher needs a good measure of the urge to point the moral. He should have the human tendency to say, "See what happens when you neglect to remove the fractions before transposing." Or "See how much better things are when you openly face the menace." This urge is so powerful in most of us that taboos have been erected to keep us from inflicting "I told you so's" at every turn. The teacher may wish to keep this urge within bounds. But the urge should be there.

The theory demands that teachers remain in contact with children and be spontaneously impelled to talk to them. The theory also holds that teachers must in some way "count" with the pupils in their care. This last requirement may imply some liking or concern for children, since an attitude of indifference or excessive distance may be detected by the pupils and reduce the teacher's influence on them. It is also expected that a genuine concern for the welfare of a pupil may enhance the spontaneous use of the necessary reinforcement, guidance, and the sharpening of insight. Beyond these exceedingly modest demands, very little in the way of emotional regard is specified.

For the use of the basic spontaneous mechanisms, no great understanding of children is required. Most of the mechanisms could be used by a person who was completely ignorant of the needs, concerns, problems, or aspirations of his pupils. The theory would predict a loss of efficiency only if the teacher's ignorance of child nature caused him to lose his influence on the pupils.

The emphasis throughout has been on blind, primitive, spontaneous tendencies common in the human race but stronger in some individuals than in others. How much could a teacher accomplish on the basis of these mechanisms alone? There are two answers: first, a great deal; second, not all that might be accomplished.

Forces such as these, operating in the traditional teacher, regularly induce a considerable amount of academic attainment. The attainment resulting from these forces has been so great, in fact, that the manipulation of more elaborate or refined forces has seldom shown

any effect (3). In experiment after experiment, classes have been reduced in size, new methods have been substituted for old, authoritarian practices have been replaced by more progressive approaches. Yet achievement continues at the same rate. Among experiments comparing these arrangements, the overwhelming conclusion is "no significant difference." Almost all practices induce some growth. Few induce more than others. There must be some ubiquitous forces that are common to almost all methods.

Although a great deal must be accomplished by these primitive forces, or by something equally untouched by administrative innovations, it would be unwise to claim that the teacher needs no other powers. Among the additional qualities that find no place in the theory we might consider the teacher's use of structure or meaning in presenting new material. Although meaningful presentations do not always result in greater learning (4), it is quite possible that skill in the use of structure may be one quality of the successful teacher. The theory also has little to say about the ability to explain, to clarify, or elucidate. Judging from the comments of grateful students, this may well be a trait that helps distinguish the successful teacher from his less successful colleague. Finally, the theory has nothing to say about any unique qualities that may enable the rare teacher to encourage originality or creativity in his students. If originality and creativity are not developed by great and outgoing interest and concern for subject matter, by rigorous standards of reinforcement, and by a wealth of guiding illustrations, the theory so far is powerless to specify the conditions under which these characteristics will emerge.

At several places in this discussion, the qualities attributed to the successful teacher have carried some unflattering overtones. We have held that the successful teacher is keenly and consistently interested in many subjects for which other people feel only passing concern. With little or no provocation, the natural teacher holds forth on esoteric or academic topics, lingering lovingly over elementary details. He is impelled to an unusual extent to comment on what others

may say about the subject of his interest. He finds it difficult to keep from correcting the mistakes of others, even when no practical purpose is served by correction.

The actual demands of the theory would be met if the teacher exhibited these traits only in the presence of juniors or potential students, laying them aside when he met with fellow adults for ordinary social purposes. But the ability to turn the tendencies on and off is not specified. On the contrary, the tendencies are more likely to function if they are spontaneous and compulsive. This feature makes it extremely likely that many good teachers exhibit the necessary traits even after school hours.

There is always the hope that the more dreary of these tendencies may be made more palatable by such qualities as enthusiasm and the ability to see unusual relations in everyday aspects of the subject. But this is not likely to provide a major remedy.

In stressing the risks to which teachers are exposed through the very traits essential to our craft, the theory is in line with a substantial segment of folklore (5) and with some empirical evidence (6). "Teacher" is the epithet that Eliza Doolittle hurls at Professor Higgins when his repeated corrections drive her beyond endurance. "Miss Schoolteacher" is the rebuke administered to Bella Goss when her overly corrected mother feels she must retaliate. Sober studies (7), moreover, report a feeling of social ostracism or lack of acceptance on the part of many teachers. In such a complex sociological picture, this lack of acceptance could be attributed to many forces and must not be regarded as due entirely to the traits imputed by our theory. It is enough to say that any reputation for social awkwardness which may in fact exist would be considered in line with the theory even though such a reputation could not be cited as proof of the theory.

Does all this imply a callous gloating over the unfortunate plight in which many teachers may find themselves? Surely not! To describe an evil or a discomfort, and to try to understand it, is not to condone or to welcome it. If teachers experience some measure of

rejection, a searching and honest inquiry into possible causes would seem the most valuable first step. All in all, it seems much more helpful to see this misfortune, if it exists, as the logical result of powerful and widespread forces, than to spend our time in protesting, complaining, and condemning. When some understanding is attained, we should be in a much better position to see what might be done. The present analysis does suggest a certain inevitability, but this is only a general analysis. A complete analysis might reveal many ways in which the basic mechanisms might be used for their valuable outcomes, but modified to reduce undesirable side effects.

All in all, these spontaneous tendencies are by no means least among the forces that enable the teacher to carry out his task. From teachers more generously endowed with these tendencies we should expect superior classroom performance.

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Evolution in the High-School Curriculum

As I look at the educational system in Britain and at what I know about the system in the United States—and I know a fair amount, for as a young man I taught in Texas for three years and have visited your country many times since—it seems to me extraordinary that the idea of evolution with all its implications is totally omitted or at any rate grossly neglected.

But this is only one of a number of points on which our present system of education falls short. In Britain there has recently been a great deal of talk about the important and unfortunate gap between the sciences and the humanities. Another striking shortcoming (which perhaps applies to the United States more than to England but characterizes both) is the fragmentation of education, the failure to give it a pattern. Much of education is a patchwork of bits of information, isolated ideas, and technical skills.

It is a shame, and indeed a scandal, that evolution has not been allowed to take its place in education, both as an important single subject and as an organizing, centralizing, unifying idea. The opposition of certain religious groups is largely responsible for this failure. Sometimes the opposition is active, as in states like Tennessee, where I understand it is still illegal to teach evolution at all. Any ideas on evolution that children get in classrooms there are bootlegged by daring teachers who smuggle the subject in under some other name. More usually there is just the general attitude: "Keep

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off this unpleasant subject." As a result, evolution is not taught adequately or indeed even mentioned explicitly. There are many places in Britain and, I am sure, in the United States, too, where the word *evolution* is hardly mentioned in high school—in class or in textbooks, let alone used as a central theme.

This silence is not only a pity; it is disastrous, because Darwin's establishment of the idea of evolution in biology is the greatest scientific advance since Newton and in many ways the greatest scientific advance ever made. It meant a revolution in the way we look at things. Professor Hermann Muller of Indiana University recently used as the title of a telling paper "A Hundred Years without Evolution Is Enough" (1). I would go further: it is too much.

It was Darwin's finding that the facts of nature did not make sense except on an evolutionary basis. This finding drove him to seek for and finally to discover a mechanism for biological evolution, the mechanism of natural selection. Today evolutionary thinking along Darwinian lines is the necessary background for all study and research in biology. No reputable biologist can begin to understand or expound his subject unless he does so against a background of evolutionary thought.

Not only is evolution the necessary background for any proper understanding or exposition of biology: but I, with many of my colleagues, feel strongly that biology is the necessary basis for understanding ourselves and nature and our place in nature.

Evolution is important for understanding ourselves as animal organisms, for instance, in connection with food, health, and disease. Evolution is essential for understanding ourselves in relation to our environment and other organisms in that environment, in other words, for understanding human ecology. Evolution is also essential for understanding ourselves as organisms which develop—in other words, for understanding human embryology and ontogeny; the most spectacular phenomenon in life is the development of adult human beings from microscopic bits of nucleated protoplasm; embryology links up with an understanding of human reproduction and with an understanding of that rather difficult but important

subject, the genetic basis of our life. Finally, evolution helps us to understand ourselves as unique organisms equipped with a new method of evolution—cultural evolution—based on the cumulative transmission of experience through language and symbols.

Embryology, reproduction, and genetics reveal all sorts of extremely exciting facts. *Exciting* is the right word, for knowledge of these facts does excite interest and wonder in our minds. I use the word *wonder* deliberately, for I believe that to excite wonder and interest in the variety and richness of life is important in education. So far as I can see, biology is the best scientific subject for eliciting a sense of wonder and an immediate interest in the strange, the unusual, and the exciting. Biology may not stir the interest of all the mechanically minded, but it does arouse the interest of a great many children, probably the majority.

Biology has the further advantage that through it you can try to enlist the born naturalist as well as the born laboratory experimenter—the boy or girl who is interested in the variety and the wonder of things as they are as well as the child who is interested in finding out how they work. It is no coincidence that all the great evolutionists have had an interest in natural history and that most of them started as naturalists.

Biology is or could be the central or key subject in the teaching of science. Biology links up with the physical sciences—physics, chemistry, and astronomy; with geology (and how neglected geology is in education today!); and with the human sciences and the humanities—archeology and anthropology, history and psychology. Biology links matter with mind. When you look at individual embryological development and at evolution as a whole, it is clear that out of something that shows no sign of mind, mind does develop. Out of an egg or an amoeba, organisms develop or evolve whose behavior definitely shows mental, or subjective, properties.

Biology also links quality with quantity. The physical sciences deal largely with quantities and quantitative measurement. In biology, in addition to quantity and measurement, patterns of organiza-

tion become increasingly important, both during individual development and during the course of evolution.

The concept of pattern of organization is important. It is one of the two new ideas that an evolutionary approach can get across. The other is the idea of reality as a process instead of a set of static mechanisms. The whole of our individual life is a process of development—including the negative development of fading out in old age. Evolution also is a process, whose most remarkable characteristic is that it tends to produce higher degrees or patterns of organization.

Evolution links man with the animals. It has been abundantly demonstrated that man is descended from animals. Recent discoveries show that the so-called missing link is no longer missing. What is more, there never was just one missing link, though in the course of evolution there was the passage of a critical point between some apelike creature that was only animal and some manlike creature that was truly man. By historical standards the passage of this critical point, or threshold, took considerable time, perhaps a quarter of a million years. The change occurred in a series of steps, one of which has been demonstrated by Dr. Louis Leakey in his latest find of an *Australopithecine* organism that made tools.

The evolutionary approach can and should be used to link man with the rest of life on this planet, to demonstrate that he is a part of life's single flow of protoplasm or metabolizing organization or whatever you like to call it, all the parts of which are related by continuity of reproduction. The evolutionary approach links man with the rest of the universe. He and all other organisms are made of the same matter and operate by the same energy as the stars and the nebulae. It is now becoming quite clear that, however we like to define life, it originated on this earth at a definite period and made the critical break-through from non-living to living matter by a series of steps. At one end of the critical passage nothing was alive, but by the other end living, self-reproducing matter had been

brought into existence. Living matter originated from non-living inorganic matter, so you have the linking up of life with the inorganic world at the beginning of biological evolution and with man at the end of biological evolution.

Eventually it dawns on us that the whole of observable reality is one gigantic process of evolution, though for clarity's sake we must divide it into three main phases or sectors, each with its own mechanism, its own rate of change, and its own type of results—the inorganic or cosmic, the organic or biological, and the human or psychosocial.

Furthermore, evolutionary biology links the sciences with the humanities. After all, what we call history grows directly out of biological evolution. History is a continuation of evolution, though by new methods, at new rates, and with new types of results (2).

Our evolutionary vision now includes the discovery that biological advance exists and that it occurs in a series of steps or grades, each grade occupied by a successful group of animals or plants, each group sprung from a pre-existing group and characterized by a new and improved pattern or organization.

Improved organization gives biological advantage. Accordingly the new type becomes a successful or dominant group. It spreads and multiplies and differentiates into a multiplicity of branches. This new biological success is usually achieved at the biological expense of the older dominant group from which it sprang or whose place it has usurped. Thus the rise of the placental mammals was correlated with the decline of the terrestrial reptiles, and the birds replaced the pterosaurs as dominant in the air.

Occasionally, however, when the break-through to a new type of organization is also a break-through into a wholly new environment, the new type may not come into competition with the old, and both may continue to coexist and flourish. Thus the evolution of land vertebrates in no way interfered with the continued success of the teleost bony fish, the dominant group of the sea.

The successive patterns of successful organization are stable pat-

terns: they exemplify continuity and tend to persist over long periods. Reptiles have remained reptiles for a quarter of a billion years: tortoises, snakes, lizards, and crocodiles are all still recognizably reptilian, all variations of one organizational theme.

It is difficult for life to transcend this stability and achieve a new successful organization. This is the reason why break-throughs to new dominant types are so rare—and so important. The reptilian type radiated out into well over a dozen important groups, or orders: but all of them remained within the reptilian framework except two, which broke through to the new and wonderfully successful patterns of bird and mammal.

In early stages, a new group, however successful it may eventually become, is small and feeble and shows no signs of the success it may eventually achieve. Its break-through is not instantaneous but has to be implemented by a series of improvements, which eventually become welded into the new stabilized organization.

With mammals, first hair came, then milk, then partial and later full temperature regulation, then brief and finally prolonged internal development, with the evolution of a placenta. Mammals of a small and insignificant sort had existed and evolved for a hundred million years or so before they achieved a full break-through to their explosive dominance in the Cenozoic era.

Something similar occurred during our own break-through from mammalian to psychosocial organization. Our prehuman ape ancestors were never particularly successful or abundant. For their transformation into man several steps were needed: descent from the trees, erect posture, some enlargement of the brain, more carnivorous habits, the use and the making of tools, further enlargement of the brain, the discovery of fire, true speech and language, elaboration of tools and rituals. These steps took the better part of half a million years: it was not until less than a hundred thousand years ago that man could begin to deserve the title of dominant type, and not till less than ten thousand years ago that he became fully dominant.

After man's emergence as truly man, evolutionary processes continued and are continuing today, but with an important difference. Man's evolution is not biological but psychosocial: it operates by the mechanism of cultural tradition. Major steps in the human phase of evolution are achieved by break-throughs to new dominant patterns of mental organization, of knowledge, ideas, and beliefs—ideological organization instead of physiological or biological organization.

Instead of a succession of successful bodily organizations we have a succession of successful idea-systems. Each new successful idea-system spreads and dominates some important sector of the world, until it is superseded by a rival system or until it gives birth to its successor by a break-through to a new organized system of thought and belief. We need only think of the magic pattern of tribal thought, the god-centered medieval pattern organized on the concept of divine authority and revelation, and the rise in the last three centuries of the science-centered pattern, organized on the concept of human progress, but progress somehow under the control of supernatural Authority. In 1859, Darwin opened the door to a new pattern of ideological organization—the evolution-centered organization of thought and belief.

To those who did not deliberately shut their eyes, or who were not allowed to look, it was at once clear that the fact and concept of evolution was bound to act as the central germ or living template of a new dominant thought-organization. In the century since *The Origin of Species*, there have been many attempts to understand the implications of evolution in many fields, from the affairs of the stellar universe to the affairs of men, and to integrate the facts of evolution and our knowledge of its processes into the over-all organization of our general thought.

All dominant thought-organizations are concerned with the immediate problems of existence as well as the ultimate ones, or, I should say, with the most ultimate ones that the thought of the time is capable of envisaging or even formulating. All dominant thought organizations are concerned with giving some interpretation of man,

of the world he has to live in, and his place and role in that world—in other words, some comprehensible picture of human destiny and significance.

The broad outlines of the new evolutionary picture of ultimates are beginning to be clearly visible. Man's destiny is to be the sole agent for the future evolution of this planet. He is the highest dominant type to be produced by more than two and a half billion years of the slow biological improvement effected by the blind opportunistic workings of natural selection. If he does not destroy himself, he has at least an equal stretch of evolutionary time before him to exercise his agency.

During the later part of biological evolution, mind—our word for the mental activities and mental properties of organisms—emerged with greater clarity and intensity, and came to play a more important role in the individual lives of animals. Eventually mind broke through to become the basis for further evolution, though the character of evolution now became cultural instead of genetic or biological. It was to this break-through, brought about by the automatic mechanism of natural selection and not by any conscious effort on his own part, that man owes his dominant evolutionary position.

Man therefore is of immense significance. He has been ousted from his self-imagined centrality in the universe to an infinitesimal location in a peripheral position in one of a million galaxies. Nor, it would appear, is he likely to be unique as a sentient being. Yet in the vast meaninglessness of the insentient universe, the evolution of mind or sentiency is an extremely rare event, and man's particular brand of sentiency may well be unique. But in any case he is highly significant. He is a reminder of the existence, here and there in the quantitative vastness of cosmic matter and its energy equivalents, of a trend toward mind, with its accompaniment of quality and richness of existence. What is more, man is proof of the importance of mind and quality in the all-embracing evolutionary process.

It is only through possessing a mind that he has become dominant

on this planet and the agent responsible for its future evolution; it will be only by the right use of that mind that he will be able to exercise that responsibility rightly. He could all too readily be a failure in the job; he will succeed only if he faces the job consciously and uses all his mental resources—knowledge and reason, imagination, sensitivity, and moral effort.

We must look at mankind in evolutionary perspective. But when we talk of the wonderful new illuminations we have received from the natural sciences in the last fifty years, let us not forget that we have also received them from the humanities. When I was a small boy, we knew very little about the prehistory of man, apart from Egyptian, Assyrian, and Mesopotamian prehistory. Then Arthur Evans discovered prehistoric Crete and well after that Sir John Marshall discovered the Indus civilization in India. Today, world prehistory is beginning to build up into a unified picture.

The evolutionary approach gives us a proper time-scale and a proper time-perspective. When you discover that it took over two and a half billion years for man to evolve from the precellular stage of life and when you realize that, if there are no catastrophes and if he is not too stupid, he has an equal amount of time before him, you look with a totally new eye at human history as it is usually taught.

It is a good exercise to get the time-perspective properly spelled out. Sir James Jeans, in one of his books, compares the length of time from the beginning of life up to the emergence of man to the height of a skyscraper. The length of time since man laid the foundations of civilization by introducing agriculture, which made settled urban life possible, would be only the thickness of one postage stamp. When I first read this passage, I did not want to believe it. I took pencil and paper and went through all the calculations and found it correct—though perhaps the postage stamp would have to be thicker than usual.

Many interesting, amusing, and thought-provoking ideas emerge

from a consideration of size in biology. I remember how astonished I was when I found that there is one protozoan, *Bursaria*, whose sausage-shaped meganucleus is so big that the smallest known insect could fit inside its transverse diameter with wings outspread. When you reflect that an insect contains many multicellular organs, such as a brain, muscles, nerves, circulatory system, you realize how remarkable this is.

There is another remarkable fact that you might like to use in your teaching some time. Show your students red blood corpuscles through a microscope. Get them to measure the diameter of one of the red blood corpuscles: it measures about seven microns. Tell your class that there are about five million red blood corpuscles in every cubic millimeter of blood. Then get your students to calculate how far all the red blood corpuscles in one's body would extend if they were put flat in a single line like a row of pennies. The result again is something I would not believe until I checked it three times. Actually, the red corpuscles would go around the equator two and a quarter times!

When I was writing *The Science of Life* with H. G. Wells, I brought this fact to him with great glee and said, "We must put this in." "Oh, no," he said in his little squeaky voice, "You can't put that in." "Why ever not?" I said, "It's wonderfully interesting!" He retorted, "Nobody would believe it, and then they wouldn't believe anything else in the book." I still regret that we did not mention it.

Let me continue with the importance of the evolutionary approach in education. By including in it the historical approach to human affairs, it can be made the unifying core of a properly worked out curriculum. This idea of a process that trends in certain main directions, though often deviously and opportunistically, and that leads to higher degrees of organization, is of fundamental importance. On the scientific side we have the idea I have already mentioned: the idea that life involves a higher degree of organization than anything found in inorganic matter and inevitably evolves under the influence of natural selection to ever higher degrees of organization and ever

greater variety. When we come to human affairs, it seems to me that history should be taught, not in the usual way, as a series of more or less isolated events—the great battles of the world, kings and queens, 1066 and all that—but as a process that tends to move in certain main directions. Something along these lines is now being attempted by Unesco, which appointed a Commission to execute the idea of a Scientific and Cultural History of Mankind. The work is proceeding steadily; when it is finished, it will, I hope, serve as a kind of bible for Unesco and demonstrate the major trends operating in human history as a whole—in other words, in psychosocial evolution.

One cannot teach all science historically: that would be nonsense. But it is important to do a certain amount of science teaching historically, if only to remind students that what they read in 1960 textbooks about chemical processes or genetics or any other scientific subject is not some sort of final revelation. Stress the fact that all the scientific ideas of 1960 are the result of a long process of trial and error, of quite a lot of error and a lot of trials. But stress also the fact that more truth and better established truth is being generated. Science steadily increases the area of human knowledge and cuts down the area of human ignorance. I am sure that it is valuable for both the student of science and the student of the humanities to have science stressed in this way, as a progressive process operating in human affairs.

What applies to science, applies also to other human activities. Such an operational or functional approach helps one realize that all these subjects to which we give abstract names, like Science and Religion and Art and Law, are not things in themselves. They are names for the collective characteristics or properties of systems of thought or action or social organization that perform certain functions in human life. We can study the evolution of law or religion or art in the same way that we can study the evolution of organs of digestion or locomotion or any other function in biology, stressing long-term trends wherever possible.

As I have pointed out earlier, anything that can be called major

advance or progress in evolution, whether in biological or human evolution, always comes about by means of a rather rapid and difficult break-through from one more or less stabilized pattern of organization to another. In human affairs the organization is an organization of thought and belief and social function; in biological evolution it is the organization of the structure and functions of plants and animals. There are long-term trends marked by series of break-throughs in psychosocial evolution—in the history, say, of food production or technology, and the same pattern may be found in the evolution of science and of religion.

I hope that I have been able to demonstrate the importance of teaching evolution and of the evolutionary point of view in the impressionable and important years of high school. It is up to educators to see how this biggest scientific advance ever made—an advance that involves a reorganization of our whole pattern of thought and belief—can be introduced into the educational system. It is up to educators to integrate this advance in a way that will prevent education from continuing to be merely a collection of credits, a patchwork of fragments that students pick up and pocket for a diploma. Through evolution, educators can help bridge the gap between the natural sciences and the humanities and provide a unified basis for a general approach to life. After all, one of the main purposes of education is to give boys and girls some basis on which they may go on thinking about nature and life after they leave school.

NOTES

1. *School Science and Mathematics*, LIX (April, 1959).
2. See the essay "Evolutionary Humanism" in my *New Bottles for New Wine* (New York: Harper & Bros., 1958). Also my *Evolution in Action* (New York: Harper & Bros., 1953); J. B. S. Haldane and J. S. Huxley, *Animal Biology* (New York: Oxford University Press, 1927).

Inquiry, the Science Teacher, and the Educator

Science educators can no longer meet in privacy nor any longer treat their problems as their own. For science and science education are now parts and instruments of an urgent national policy, and the teachers, researchers, and teachers of teachers who lead these enterprises are joint executors of that policy.

Furthermore, they face a new problem that stems from science itself—a problem new in so great a degree that it amounts to a difference in kind. The elements of novelty are so potent, indeed, that the problem will not be solved by the means and methods which have adjusted science education in the past. Redistribution of student time, the reordering of standard units and departments of instruction, and new techniques of teaching will be needed. By themselves, however, these ameliorations will not adjust science teaching to the change in science and to the national need which now faces us. A much more radical overhaul is in order, one which will involve the very content of many of our courses, their aims, their methods, and their essential structure.

What are these factors which, to such great extent, shape our problem? The first is the urgent need to rebuild the capital of American brainpower and its popular support, a capital we have spent with little replenishment over the past forty years. The second, the change in science, is its transformation from a literal-minded empiricism to a complex in which conceptual invention plays a

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vast role, determining the facts we seek and conditioning the meaning we confer upon them. Let us look first at the change in science, for this change determines the kind of brainpower and the kind of popular support national policy requires.

For a brief time in the nineteenth century, most scientists were convinced that science was a matter only of seeking the facts of nature and reporting what one saw. In biology, for example, the major problems of the field were so complex, so remote from solution, that the scientist was satisfied to postpone them to an indefinite future. He called them "philosophical," thus relegating them to a realm where they could largely be ignored. Thus, he was freed to uncover his hard-to-come-by facts and to treat his primitive guiding concepts—of a living "machine," of structure and function, of simple causative agents—as if they too were facts and not to be questioned or tested.

Some physicists and mathematicians—Karl Pearson, W. K. Clifford, Lord Kelvin, for example—committed themselves to a similar position. They deplored the existence even of Newton's conceptions of Force and Matter: these were blots on the copy book of science to be erased in favor of a pure report of what was immediately measurable.

Such assertions as these came on the very eve of the discovery of radioactivity; and with that discovery, there ensued a revolution in science comparable only to that engendered by Copernicus. This revolution was originally a revolution in the conceptual structure of physics. By the mid-twenties it had gone so far that we were face to face with the fact that even the most venerable of our notions of the physical world had only limited validity. The fixed-dimensioned body, the homogeneous neutrality of space, a flow of time which was always and everywhere the same—these notions were questioned and found neither wholly adequate nor irreplaceable.

This revolution in physics is now being matched by a revolution which affects all science. With the disappearance of the self-evident

givenness of fixed dimensions, and the traditional properties of time, space, and motion, self-evidentness itself is disappearing. For the purposes of science, facts can no longer be treated as self-existing givens. They are matters contingent on the knower: on the operations he performs to bring them into view and on the conceptions which organize and control his operations (1, 2).

By this revolution, scientists are not merely privileged to try new conceptual patterns, they are entering into an obligation to do so. Today, the obligation has permeated the physical sciences and conspicuous members of the social sciences. It has also penetrated the frontiers of biology, that most conservative of the sciences. As one biochemist has said of science: "It looks at its facts, concepts and laws as a temporary and rapidly changing codex, reflecting the momentary state of affairs" (3).

What are the consequences to education of this revolution in scientific inquiry? Let us trace them through one of the several effects which the revolution has imposed on scientific knowledge—the rise to prominence of a new dimension of progressive revision of scientific knowledge.

Under the older dispensation only one conspicuous criterion determined whether a statement were truly scientific: Was it *reliable*? Reliability meant that the data which grounded the statement could be seen by others with appropriate precision and accuracy. If a statement met this standard, it was inscribed on the roll of science.

Under this conception, scientific knowledge and permanent knowledge were treated as synonymous. Science was supposed to grow only by accretion and by added decimal points. New facts were added to older ones; some older ones were rendered more precise. But, on the whole, science was conceived as a body of separate statements so nearly independent of one another that no new statement could send an older one to oblivion.

In the present view, we ask scientific knowledge to meet an additional criterion. Let us call it *validity*. The standard of validity

asks that the data we use shall be not only reliable but representative. It asks that the data reflect as much of the richness and complexity of the subject matter as possible. We are no longer content with just any discoverable reliable truths about a congeries of items. We want truth about them which will be organized and telling, which will give us a full and a satisfying account of the subject in question. We are no longer happy, for example, with research on learning which studies only the learning of separate scraps of material or minimizes the history, the likes and dislikes, the personality and the motivations of the learner. Rather, we want an account of learning which places learning in the whole rich context which affects it.

In biology, similarly, we are no longer satisfied with a compilation of the functions of organs, tissues, cells, and enzymes, however accurate and complete. We also demand that the very conception of separate, stable units, each with fixed functions, be tested for validity. Does this model adequately represent the full, interacting, self-regulative complexity of the organism, or is it too simple? If it is oversimple, we must find a new conception to guide new research which will seek quite a different constellation of facts and interpret them in a new way.

The demand for growth in validity leads to the revisionary character of science. Early investigations in a field use guiding concepts of the subject matter which are necessarily simple. As the concepts are used, knowledge of the subject unfolds and leads to refinement and invention of techniques. The new knowledge lets us envisage new and more complex conceptions. The growth of technique enables us to put these new conceptions into practice as guides of new research. With each such change in the conceptual system, the older knowledge gained by use of the older principles sinks into oblivion. The facts embodied are salvaged, reordered, and reused, but the knowledge which formerly embodied these facts is replaced.

There is, then, a continuing revision of scientific knowledge as principles of inquiry are used and tested. The cliché that science

is cumulative refers to development of knowledge, not to mere increase in amount. Each new fact discovered through the guidance of new conceptions throws a new light, a new meaning, on facts already known. The old meanings, expressed in the older statements of the science, are no longer adequate. They are replaced by new knowledge which is more comprehensive, more complete, or more discriminating than the old.

At the present tempo of research in the Western world, I would estimate the duration of a revisionary cycle in a median science to be on the order of fifteen years. Thus a body of knowledge acquired in the conventional way by a graduate of 1960 is likely to be largely inadequate by 1968 and, by 1975, as obsolete as notions of body humours, the ether, or the impenetrable atom.

The gross implication of this revisionary process for science education is frighteningly obvious. It means that the notion of coverage, of conveying the current knowledge of a field, which was once the essence of science teaching, is called into question. It means that *expertise*, authoritative possession of a body of knowledge about a subject matter, is no longer enough to qualify men as the best teachers of science. It means that the education of the science teacher must be something more than, perhaps something quite different from, the inculcation of conclusions and training in ways and means to pass them on. It means that time-hallowed instruments of instruction—the lecture which aims to be simple, clear, and unequivocal; the textbook which aims to eliminate doubt, uncertainty, and difficulty; the test which aims primarily to discover what the student knows and how he applies what he knows about a subject—these will be inadequate or even inappropriate for much science teaching.

We shall return to these matters more positively and more discriminately later. For the moment let the general alarm suffice while we turn to the second massive determinant of our problem, the urgent national need which currently suffuses American industry, research, and education.

The national need is the need to rebuild our capital of trained, scientific manpower and its popular support, for both have fallen to dangerously low levels. In the past fifty years we have exploited the capital resources of science with great success and ingenuity. This exploitation has been of two kinds. The first form has been technological exploitation—the application of established scientific formulations to the production of material needs and luxuries.

The second form of exploitation is less commonly distinguished from the whole body of science. It consists of the pursuit of *stable* scientific inquiry at the expense of *fluid* inquiry. By *stable inquiry*, I mean researches which receive their conceptual principles from others and treat these principles as matters of fact, not matters for test. If *organ* and *function* are current conceptions, the stable researcher is concerned with discovering the function of this organ, then that, then another. If the conception of the *gene* is current, the investigator sets out to discover what genes are involved in first one and then another inherited characteristic.

In each stable inquiry, the investigator's eye is on the immediate outcome, the filling-in of a particular blank place in knowledge. The blank place itself and the way to go about filling it are conferred by the principles of inquiry. The stable inquirer thus uses his principles as means of inquiry, but not as objects to be inquired into. The principles define his problem for him and guide the patterns of experiment which will solve it, but the principles are not treated as problems in themselves.

In fluid inquiry, on the other hand, the aim of research is to test the principles and ultimately to revise them or invent replacements for them. The goal is not the immediate knowledge of the subject which use of the principles may lead to, but the discovery of the limitations of the principles as intellectual tools of long-term programs of stable research.

These two activities—technology and a stable inquiry—are enormously valuable in themselves. But in the United States in the past fifty years we have pursued them in such a way that they have

become an uncompensated disbursement of capital. Two conditions make such an outcome possible. First, both stable inquiry and technology require the prior existence of their intellectual foundations. Technology must have its body of scientific theory as a base. Stable inquiry must have its principles of inquiry as a base. Moreover, these bases wear out. It is quite possible to exhaust the technological possibilities of a given body of scientific knowledge. Each technical development generates new needs and new wants, and, eventually, these reach such a level of novelty that they can no longer be served through the existing body of knowledge. In the same way, stable inquiry exhausts its principles. Ultimately, all the important questions which they permit are asked and satisfactorily answered, and the answers exhibit new vistas of ignorance and complexity which the principles are unable to encompass.

If, during such a development, we also maximize the social, monetary, and psychological rewards for technology and stable inquiry, the consequence is obvious. Most—perhaps, nearly all—of our energetic and able will be attracted to these fields. Few will turn to the fluid inquiry which can refresh and replenish the knowledge and the principles that provide the bases of techniques and stable inquiry. Withdrawal will far exceed deposits. This process can go so far that not one person in ten thousand attracted to the field of science even knows that such a thing as fluid inquiry exists.

Until recently, we could compensate in part for our neglect of fluid inquiry by borrowing intellectual capital. England, France, Germany, and Scandinavia trained their potential scientists with quite a different emphasis, one which assigned a much higher place to fluid inquiry. They meted out rewards with a commensurate difference of emphasis. Hence, their scientists undertook numerous tests of principle and developed new conceptual frameworks. These entered the stream of intellectual commerce and were freely available to us.

For reasons I shall not discuss, this stream has dwindled, and its course has been dammed or impeded. We are beginning to be alone.

We are grown up now and must learn to take care of ourselves. Meanwhile, the Soviet Union has grown big, not only in technology but in the pursuit of fluid inquiry. Since the stream between them and us most assuredly does not flow freely, we are not only alone, we are hard pressed. It is now time and past time for us to make our own way.

Before passing on to problems of education proper, we must deal with one more distinction, that of standard and original engineering. In engineering, too, there is a scale of professional activity that parallels the distinction of stable and fluid inquiry. There is a way to teach and practice engineering which corresponds to stable inquiry. The student receives a maximum load of the standard practices in his engineering field and a minimum of the scientific knowledge on which the practices are based. His engineering competence is correspondingly standardized. When he faces a problem, he scans, mentally or actually, the file of past solutions to similar past problems. He finds a solution which nearly corresponds to his problem. Then he adapts it in small ways to the particular exigencies of his situation. This, let us call *conventional* or *standard engineering*. It is extremely useful but extremely limited. It solves many problems that arise in the ordinary course of technology, but it is limited to problems that are very like previous problems. It cannot cope with problems whose novelty factor is high.

There is another way to teach and practice engineering, a way which corresponds to fluid inquiry. The candidate gets a thorough grounding in the sciences on which his branch of engineering is based. He studies samples of the way in which standard practices have been developed from these basing sciences. He is put in learning situations which encourage him to derive other practices from other aspects of the basing science. His engineering practice is correspondingly original. When he faces a problem, he turns to his basing sciences. He searches out the aspects of them which bear upon his problem and seeks among them for clues and cues from which to invent and develop a new principle of engineering practice.

This, let us call *original engineering*. It is a complement to conventional engineering. It deals with problems where novelty level exceeds the grasp of conventional engineering.

Just as we in the United States have emphasized stable inquiry and technology as a whole at the expense of fluid inquiry, so we have created a similar imbalance within technology. We have prepared many conventional engineers; too few original ones. Meanwhile, our engineering problems have gone through the ceiling of novelty with which conventional engineering can cope. The exigent problems of propulsion and guidance of missiles, of space exploration, space medicine, and biology cry out for new and original principles of engineering.

Here, then, is the situation which science education is called on to face. We must so recast the internal structure and content of our courses, our aims and practices, that our teaching will redress the balance. We are asked to discover, select, motivate, and launch an increasingly large group of fluid inquirers and original engineers—and to help develop a non-science public which understands the nature and consequence of the work these scientists do.

To develop the consequences for educational policy which these matters portend, let us examine what our teachers will need to teach. This will show us what our teachers need to know.

What our teachers need to teach is determined, first, by the fact that our national need is a dual one. There is need for an increasing number of fluid inquirers and original engineers. There is also need for a voting and supporting republic of non-scientists who understand the work scientists do. This dual need in turn creates a dual clientele within the schools—those who are, potentially, consumers of scientific knowledge and those whose potential interest and special competences distinguish them as possible makers of that knowledge. For these two groups, our aims will not be wholly the same. The second group will require more from us than the first.

The need of the first group is for a valid image of research and

of scientific knowledge. This, most courses in science do not supply. The traditional course has been, on the whole, a literal treatment of science and a rhetoric of conclusions. The traditional course has tended to treat only the outcomes, the conclusions, of inquiry, divorced from the data which support them and the conceptual frames which define—and limit—their validity. The traditional course has treated the terms of these conclusions—such notions as Force, Gene, Kinetic Energy, physiological function, biological species—as if they had the same literal standing and existence as this desk—here—now and corn flakes.

The result of this conclusional and literal rhetoric has been to convey a false image of science. It is seen as knowledge literally true, permanent—even complete. This misleading image is further enforced by the neatness with which our courses are usually organized and expounded. We tend to provide a structure which admits of no loose ends. We minimize doubts and qualifications. We strive for exposition characterized by an almost artistic beginning, middle, and end.

The result of these habits has been—unintentionally, to be sure—to create a climate of opinion inimical to science. From ignorance of the limited scope and validity of scientific conceptions, students are led to expect certain behaviors of common-sense objects, behaviors which simply do not occur. This breeds cynicism about science and its value, a cynicism summed up for many of our students by a walling-off, a total alienation of the ideas of theory and practice, science and common sense.

From failure to discriminate datum and conception and to understand the role of each in science, the student is led to treat conclusions as inalterable truths. When, five or ten years later, this conviction proves false, he retreats from clarity to confusion and from confusion to generalized suspicion of scientific competence and authority.

To avoid these unintended meta-consequences of our teaching, we need to imbue our courses and our exposition with the color of

science *as inquiry*. We need to give the student an effective glimpse of the vicissitudes of research. He needs to see the scientist try to subjugate the complexities of nature to the limitations of available methods of research. He needs to see the readiness with which the inquirer moves to challenge the soundness of his own work and to start afresh. Most of all, he needs to understand the conditional truth of scientific knowledge. Wherever possible, he needs to know the specific, concrete conditions which limit the truth and the application of the bodies of knowledge he is taught (4).

We need to go one step further. If a student is to keep rapport with the changing face of science when he is no longer a student, he must be freed as far as possible from the need for schools and schooling. He needs to develop the competences and the habits required to read and learn for himself. This need will require us to test that most cherished fantasy of the teacher—that students truly learn only with our help. In our courses we will need to set off certain segments of subject matter for the student to master by himself. Parts of some examinations must be concerned with testing competence to do such work and include, as a matter of course, the same sorts of queries on matters self-learned as are used on material mastered with the help of the teacher.

Scientific literacy of this kind as an objective of the school means that the teacher will have to be concerned with a great deal more than the mechanics of reading and the use of reading aids. On the intellectual side, it means encouraging a search for the kinds of meanings that characterize inquiry. This search requires a sensitivity to the changing formulation of problems and to their growing validity. It includes identification of new conceptions and appreciation of their role in the new inquiry. It involves the noting of the data adduced and a judgment about its adequacy. On the emotional side, scientific literacy involves a growing up, a renunciation of dependency and passivity in favor of readiness to rely on one's own resources. These competences are a far cry from mere willingness to do the assigned, from receptive ability to understand the given, and from a simple appetite for acquiring facts as stated.

So much for students in general. Before we turn to the potential scientist and his additional needs, let us look at some of the materials and methods by which the curriculum can serve the needs of science as inquiry.

The laboratory is easily converted to inquiry and, happily, good work in this area has been initiated. In general, the conversion takes place by having the laboratory "lead" rather than "lag" the classroom phase of science teaching. The laboratory ceases to be a place where statements already learned are merely illustrated and where perception of phenomena occurs within the restrictive structuring of terms and concepts already laid down. It ceases, too, to be preoccupied with standardized techniques. It becomes, instead, a place where nature is seen more nearly in the raw and where things seen are used as occasions for the invention and the conduct of programs of inquiry. The laboratory manual which tells the student what to do and what to expect is replaced by more permissive and open material (5, 6).

Three levels of openness can be discriminated. At the simplest level, the manual poses problems and describes ways and means by which the student can discover relations he does not already know from his books. At a second level, problems are posed by the manual, but methods as well as answers are left open. At a third level, problem, answer, and method are left open: the student is confronted with a raw phenomenon—let it be even as apparently simple a thing as a pendulum. He pushes and pulls, alters first one and then another of its aspects, begins to discern a problem to be solved, then moves toward its solution.

Besides its openness, the inquiring laboratory is characterized by a second general feature: it erases the artificial distinction between classroom and the laboratory, between mind and hand. The team of students who encounter a phenomenon in the raw do more than merely pull and push, time and measure and describe. Once alternative possibilities have presented themselves, discussion ensues. The feasibility and the validity of different problems are debated. Techniques are devised and criticized; assumptions uncovered and

identified. Then there must be consensus and a division of responsibilities. Finally, at the end, when research reports are written, circulated, and read by different teams, there are discrepancies to be checked or accounted for in the interest of further consensus.

All these activities are part and parcel of inquiry as it actually occurs—including unresolved debates, continuing diversity of problems and methods, and, above all, continuing differences in concept and interpretation.

By contrast to the laboratory, the textbook, the classroom, and the lecture have seen less extensive revision toward support of an inquiring curriculum. Yet, here too, pioneering development and study are taking place (7, 8, 9, 10). In general, the inquiring classroom is characterized by the dovetailing of two components which, together, permit what I shall call *secondary inquiry*, or, better, *an inquiry into inquiries*. First, materials are provided which afford scope for such secondary inquiry. They are reports in one form or another, not of the conclusions of research taken alone, but also of the problems, the data, and the interpretative processes by which the conclusions are reached. Wherever feasible, the materials include contrast in order to widen the scope for secondary inquiry: alternative formulations of problems; alternative experimental patterns, and debates about assumptions, principles, and interpretation.

Such materials, read or heard by the student—with or without aid from teachers, lexicons, notes, or conventional textbooks—provide the base for the second component of the inquiring classroom. This second component is discussion—discussion in a sense appropriate to scientific material and endeavor (11). Such discussion is concerned with the elucidation, the understanding, and the attempt at critical evaluation of the materials at hand. It is not a forum for irresponsible expression by students of their uninformed opinion on the subject. Neither is it the occasion for mere quizzing about the surface content of the readings. Rather, it treats the materials read *as reports*. Questions concern the actions, judgments, and decisions of the scientists which the book or lecture described.

The questions normally begin with consideration of the problem posed by the inquirer: what it is; how it was generated and made important by previous knowledge in the field; what terms and conceptions the problem involves; how these conceptions agree with, or deviate from, those of previous researches read by the student, and the purpose served by consistency or deviation. The questions then move on to consideration of the data involved: what data are required to solve the problem, how far the data actually sought fulfil the requirements set by the problem; what limitations of instrumentation or knowledge necessitated constriction of the data sought. Questions then pursue the remaining phases of inquiry: how the data are interpreted; what doubts, what new and untested notions accompany the interpretation; how the new knowledge affects what was previously taken as knowledge of the field.

For such inquiry into inquiries, three distinct patterns of materials and methods have been devised and tested. The simplest, and the one most similar to a rhetoric of conclusions, I shall call *climactic narrative*. Climactic narrative begins with description of phenomena which symbolize the field to be treated. The symbol may be a dramatic one, such as the slowing of a pendulum clock transported from Paris to the tropics. With such a starting point, a problem is formulated, and the narrative moves thereafter from one experiment, its results and interpretation, to another until it reaches its intended stopping place, its climax theory.

Discussion begins where the narrative ends—with a non-inquiring review of the climax theory. If Bohr's model of the atom was the climax, the first questions might be "What is an orbit?" Or "What is a shell?" Or "What is h in the equation for angular momentum?"

Then discussion would move into the current of the inquiry: "Why did Bohr postulate a limited number of orbits for the electron of the hydrogen atom?" "What is the connection between Bohr's postulate and the Balmer series?" and so on through earlier and earlier contributions to the climax theory.

This pattern of materials and discussion is effective but limited.

It is limited by the fact that the linear pattern of narrative tends to convey a sense of unobstructed progress toward the climax theory and tends to treat the climax theory as whole and complete.

The second pattern of materials and methods, which we shall call *multilinear exposition*, overcomes these limitations. Multilinear exposition is characterized by description of alternatives, difficulties, and doubts attendant on inquiry. Some of the alternatives taken seriously at a given time are examined in the light of their various supporting evidences. There is emphasis on the uncertainties and losses involved in choosing one alternative over another. The inevitable dubieties and debates which attend interpretation of data can be illuminated.

With materials of this kind to work with, the scope of possible inquiry into the inquiry is much increased, and more participation by the student can be evoked. He can array arguments in favor of one explanation as against another, express a preference (with reasons), and thus invite fruitful debate with other students who have reasoned preferences for other explanations. Then the various emphases, reasons, evidences, oversights, and misconceptions involved in the students' debate can themselves be subjected to scrutiny. In these ways, and a number of others, multilinear exposition and the discussion it makes possible are much more fruitful than climax narrative.

The third pattern of materials and methods uses actual reports of inquiries, original papers from the journals of science. A coherent set of such papers is usually employed as an interlude of depth and firsthand contact with scientific reporting in connection with materials of other kinds. Thus a study of genetics might be initiated with Mendel's original contribution and one of the papers by E. M. East on the inheritance of continuously varying characters. Thereafter, the burden might be carried by climax narrative, multilinear exposition, or traditional rhetoric of conclusions. Similarly, textbook material might introduce a study of endocrine function to be super-

seded by a set of actual research papers on one of the endocrine functions—the thyroid, or the pancreas—and textbook study resumed thereafter.

Let these instances suffice to suggest the forms which the inquiring curriculum can take, and let us return to the problem of the potential scientist.

The additional problem posed by the potential scientist among our students is primarily one of appropriate motivation and self-selection (12, 13, 14). In the past, we have relied heavily on two criteria which are inadequate to present needs. We have sought the student who is attracted by the subject matter of our science or by its technical methods and devices: live things, telescopes, electronic devices, dissection, collecting, construction. We have also tended to seek out students whose intellectual predilection has been primarily *acquisitive*—acquisitive of facts, of technical vocabulary, of rules and formulas, of technical know-how.

These criteria are useful, but they are not enough. Taken alone, they may identify stable inquirers and standard engineers. They provide little, however, by which the student of original mind and a bent for frontier investigation can identify himself and be attracted.

For this student, we need to provide opportunities of quite a different kind. He needs to discover that science affords an opportunity to challenge the truth of existing rules and "laws." He needs to discover in science the excitement of pursuing something that others have not yet caught. He also needs to discover whether he has the stamina for fluid inquiry and original engineering—the stamina necessary to sustain the burden of uncertainty and the possibility of failure which are the regular risks of frontier enterprise.

For these purposes, the potential scientist needs exposure to the most completely open and unstructured versions of the inquiring curriculum. For him, the laboratory work which specifies neither problem nor method is the appropriate one. The classroom which rests most firmly on the uncertainties, doubts, and difficulties of first-

hand reports of investigation is the one most likely to evoke his competence and interest. Through the activities of invention, analysis, and critical evaluation these classrooms and laboratories afford, he can participate in, and be conditioned to, the vicissitudes of inquiry.

We turn now to the program of teacher education required for an inquiring curriculum.

Much of what can be sketched in outline is already obvious. A teacher whose own study has been dogmatic and doctrinaire will be unprepared to teach science as inquiry. A teacher whose own training has demanded, or done little to discourage, acquiescence, dependency, and passivity will, in all likelihood, demand the same of his students. The first of these strictures bears mainly but not exclusively on the teacher's training in subject matter. He will need to have a substantial part of that training in the form of inquiry into inquiry—enough of it to equip him with the ability to read and understand reports of inquiry. He will need to become familiar with the sorts of questions whose answers illuminate such materials. He will, himself, need to understand the ways in which invention and observation, datum and conception, interpenetrate to form the growing fabric of scientific knowledge. It is in this way, by developing the competence to participate in the movement of scientific inquiry, that the teacher of science can, in truth, be a scientist.

The second stricture, that a teacher whose training involved passivity and dependence will demand the same of his students, applies to all parts of teacher education. In his subject matter, in his preparation to be a teacher, and in his general education, a program of auto-instruction is called for. This dictum is supported by two major reasons.

The most immediately important may be that self-instruction is the only practicable solution to the problem of "coverage." The problem of finding enough time to "cover" what we wish to cover in the teacher-training curriculum is not and, for years, has not been, a problem of finding enough student time. It has been a problem of finding enough classroom time and enough teacher time to "cover,"

in the conventional way within the conventional framework of inelastic semester hours, on the assumption that all "coverage" must be coverage in the classroom. I now suggest that a substantial part of "coverage" be "covered" by the student on his own.

If our students are outraged and recalcitrant when first faced with the necessity to read and study for themselves—as I am sure many of them will be—it is our own fault and spells out only the problem of moral re-education which we face—a problem created by our past indulgence of the student and of our own need to feel indispensable. It may, indeed, take some time before most students are re-educated to a reasonable work week and to self-reliance, but this is no reason not to begin. I would estimate that a first year of college directed to development of competence for self-instruction would yield such dividends that the quality content of the curriculum as a whole could be increased by at least 30 per cent.

The second reason for a pervasive auto-instructive component in the curriculum consists of the great post-collegiate value of such a skill. It obviates the teacher's great dependence on inculcative summer refresher courses and institutes and frees that time for more interesting and constructive work.

A third and last remark on self-instruction. It must be pervasive. It should be instituted in all phases of teacher education if it is to be effectively developed. If science departments alone demand it while education and the humanities do not, the students will view it as a special and unreasonable imposition. If all departments demand it, it becomes a regular part of the college culture as seen by students, and they soon cease to be intimidated by it.

I shall close with consideration of a pressing, practical problem. How many of our high-school students, how many teachers and teacher-training institutions should be involved in an inquiring approach to science? The first impulse is to view inquiry as something for very few, for the top 5 or 10 per cent of students, teachers, and institutions. I do not believe this to be the case.

I do believe that, in the present climate of attitude and habit,

inquiry will be immediately accessible only to a few. For most students entering high school in the next year or two, it will be a shocking change of pace. For most high-school students entering teacher training in the next few years, it will come as a similar shock. But this very sequence suggests what the future can hold. As a few teachers enter the high school and introduce an inquiring curriculum, more and more students will enter college who have been well conditioned to the process. They will move at a faster and more effective pace through teacher training and go out to accelerate the rate at which inquiry permeates the schools and returns its dividends to the colleges.

Before we turn a skeptical ear to a forecast of such extensive effectiveness, let us remember what happened in literacy. The same apparently obvious facts about educability and the same "common sense" which may now tell us that inquiry is beyond the competence of average men and women once led to the same pronouncement about teaching the ordinary man to read and write. Indeed, the first efforts at invoking literacy among persons disinherited from any expectation of it were stumbling and of scant success.

Then two accelerating processes occurred. The increase of literacy spread the atmosphere of literacy, and more and more people came to expect it as a matter of course. This very expectation did away with many of the barriers which formerly made reading and writing difficult to learn. Meanwhile, as a literate milieu broadened among the educated, so did competence to teach literacy broaden among educators. New materials, new methods, and new insights into difficulties arose and became common property.

It is not too much to hope for a similar outcome to efforts to teach science as inquiry.

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Educational Measurement: An Aid to School Administration

We are in a period of rapid expansion in school testing. According to an annual survey conducted by the American Textbook Publishers Institute, the increase in the use of tests in this country from 1955 through 1959 averaged more than ten million tests a year. In 1959 alone, approximately one hundred and forty-seven million tests were given, about 85 per cent of them in schools and colleges (1).

It has taken some fifty years for objective tests and measurements to reach their present state of development in American education. From a small and unimpressive beginning early in the 1900's, measurement has gradually expanded, both in breadth of coverage and depth of probing, until it now impinges upon a large segment of the student's school life.

The current expansion in educational measurement has some noteworthy advantages for schools. It is bringing to an ever increasing number of schools and pupils a powerful set of tools that may be used to enrich the guidance of the individual pupil and to improve the educational program of the school as a whole. Furthermore, these tools are not static. Efforts are constantly being made to improve them as the work of measurement theorists and research specialists is brought to bear on the problems of test construction and as measurement personnel and teachers co-operate more closely in test construction.

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But the present expansion is beset by dangers, too. Unless school administrators, teachers, and counselors understand the meaning and the implications of test results and unless full and wise use is made of the scores, the giving of larger numbers of tests may be mostly a waste of time, detracting from instruction and contributing to feelings of insecurity on the part of the pupil and his parents. The crux of the matter is in the understanding and the use of tests.

The key person in developing better understanding and better use is, of course, the administrative head of the school. The value of the testing in his school is determined largely by his understanding of, and his attitude toward, educational measurement and evaluation; his ability to communicate his understanding and his attitude to the faculty, the school board, and the community; and his willingness to earmark sufficient funds, not only for the routine aspects of testing, but also for the organization of test data and for an in-service program on the use of tests.

What contributions can measurement make to administration? What are some essentials for realizing these contributions? What administrative problems are being created by the present upsurge in testing? These questions are worth exploring.

Measurement can make helpful contributions to at least four important needs of school administrators. The first of these is the need for pertinent facts about the children enrolled in school. The administrator who can draw on sound information is at an advantage in planning a curriculum that provides for the entire range of pupil ability. Much general information of this kind can and should be inferred from observation of the pupils, from study of their educational and vocational goals, and from consideration of the community served by the schools. Still, tests add objectivity and a degree of confidence to the observations.

Except in schools that are quite small, administrators are probably more directly concerned with information about groups than about individuals. Tests may be used to yield several kinds of information

about school groups. Tests can tell how the scholastic aptitude of one group compares with national and regional norms or with norms for pupils who have various educational and vocational goals—pupils preparing for liberal arts colleges, for technical courses, or for business employment. Test results can be used to compare school achievement with norms or, more importantly, with scholastic aptitude. Test results can give information on pupils' interests and personal qualities. They can give useful information on the rate of educational development in the school.

A second and even more important need of school administrators is to provide for the collection and the dissemination among the members of the faculty of objective information about individual pupils, information which will help teachers and counselors do a better job. Tests of scholastic aptitude help the teacher understand the potential of each pupil and gear instruction to that potential. Achievement tests in the various subject fields enable the teacher to check on the progress of his pupils and to compare the achievement of each pupil with his scholastic aptitude. Such comparisons can be made if the results of achievement tests and aptitude tests are expressed in norms derived from the same population or from similar populations. In making such comparisons, it must be recognized that both these kinds of tests are actually combinations of aptitude and achievement but that aptitude tests attempt to emphasize aptitude while achievement tests undertake to stress achievement. Many achievement tests—as, for example, reading tests which yield separate scores for rate, vocabulary, and comprehension—also help the teacher diagnose the strengths and weaknesses of his pupils in broad areas.

For guidance purposes, the work of counselors is greatly helped by all kinds of measures—measures of scholastic aptitude, achievement, interests, special aptitudes, and, even on occasion, personality. With the possible exception of personality measures, these instruments are not necessarily different from tests used by teachers, but the results may be more intensively applied to the solution of the problems of individuals than the results of tests used in the classroom.

A third important need in school administration is for research on administrative problems. One of these problems is evaluation of pupil progress toward the major objectives of the school. Some objectives, like those in the broad field of values, may be intangible, and evaluation procedures other than measurement may be called for. But many learning objectives of the classroom lend themselves well to measurement, and tests are an indispensable basis for research on them.

Somewhat related to research on objectives is research on the curriculum. Such research is particularly important during a period of rapid change in a curriculum field, as, for example, the current foment in secondary-school mathematics. As schools make the transition from the traditional curriculum to the newer curriculum in mathematics, the demand for new tests is so insistent that organizations like the Educational Records Bureau and the Educational Testing Service are giving this need high priority in their test-construction plans.

Another area of research that has important implications for school administration is prediction of educational and vocational success and the value of various predictors as judged against criteria of success. In the current period of critical appraisal of the schools by the public, the question of how well graduates of local school systems fare in institutions of higher learning and in vocational pursuits is a persistent one that administrators and school boards must answer. Although school marks continue to be the best single predictor of later success, tests also have validity for predictive purposes, and a combination of tests and marks may have higher predictive validity than either used alone. Research suggests that cumulative records of test scores predict college marks somewhat better than tests administered at one time, such as at the middle of Grade 12 (2).

Still another research area important in school administration is experimentation with new ways of organizing the curriculum and new methods of instruction. Do pupils achieve better under a core curriculum than under a traditional organization of subject matter? Is homogeneous grouping conducive to better achievement than heterogeneous grouping? Tests are essential for rigorous research on

such questions. One prime illustration is the national program in the use of television in the public schools, a program that is now in its third year in some ten large cities and in three states. Tests are not the only basis of appraisal in studies of this kind, but without the use of tests in controlled experiments in the centers involved, and without reports of test results for the benefit of administrators elsewhere, such studies would have little meaning.

A fourth important need of school administrators is for dependable information about the quality and the effect of the school program, information that may be used in public relations. School administrators need to give the public general information about the school as a whole through reports and news releases; and from time to time they need to confer with parents about individual pupils. Information on test results is included in general information released to the public, but tests are used for this purpose less frequently than for supervisory, instructional, and guidance purposes (3). No doubt many administrators fear that such information may backfire. However, good illustrations of the annual publication of test results may be found among reports of city school systems (4).

In conferences where there is ample opportunity to explain the meaning of the scores, schoolmen often inform parents of the results of individual achievement tests (5). More frequently, information on test results is used for guidance purposes, although the information may also have value for administrative purposes. For example, it may be useful for classifying and placing pupils who are being admitted to a school.

A worthwhile measurement program requires several essentials. The first of these is co-ordinated, continuous planning and school-wide interest in the program. Perhaps the best procedure is to appoint a school-wide measurement committee that represents administrative officers, supervisors, teachers, and guidance workers from the various units of the school system and to have this committee work closely with a professionally trained director of testing.

A second requisite is a regular, systematic, all-school testing program supplemented by special tests to meet individual needs. One of the principal weaknesses of educational measurement is that many school testing programs are haphazard. In fact, there is a mistaken impression in many schools that it is desirable to use many different tests with as few repetitions as possible from year to year. On the contrary, for administrative purposes, as well as classroom and guidance purposes, it is best if the measurement committee, after careful consideration of all available tests, sets up a program of comparable tests for use over a period of years with only such changes as are needed to take account of obsolescence of existing tests and publication of improved instruments. At the same time, flexible use of supplementary tests on the part of teachers and counselors should be encouraged.

A third requisite—one of the most important of all—is to maintain a well-organized cumulative record of each pupil's entire school experience. The record should include all significant areas of his experience, not simply those which are measurable. A systematic testing program and a well-designed, up-to-date cumulative record are the chief means by which an otherwise chaotic measurement situation may be made to serve the administrator as well as the other personnel of the school system.

A fourth requisite is a continuous program of teacher education in the use of tests. In nearly all schools this kind of training program is imperative. Most teachers who have a bachelor's or even a master's degree are inadequately prepared to understand and use objective tests. They may have received a smattering of information about measurement in courses in methods and educational psychology, but usually this is not enough to be of much help. It would be highly desirable if a course in educational measurement were made a requirement for graduation and for state certification. But until this requirement becomes a reality, school systems must themselves assume the burden of in-service training to assure that tests will be used wisely. The training should be given in a continuous program

that is integrated with the actual use of tests. The services of psychologists and others in the school system or the community who have special understanding of measurement should be enlisted for leadership. Almost any teacher can learn to interpret and use test results, but there is a minimum of technical understanding and elementary statistics that ought to be inculcated before teachers undertake to use these instruments, which, in incompetent hands, may do more harm than good.

A fifth essential for realizing the potential contributions of measurement is an awareness of the legitimate uses and the limitations of tests. No test has perfect reliability. The score that a test yields is only an approximation of the pupil's true score—a score that might be obtained through administration of a limitless number of tests of the same kind. Small differences in score are, therefore, meaningless. The advisability of disregarding small differences between test scores is pointed up by publishers of some series of tests for which the results are reported in bands of scores rather than in single scores (6).

A published achievement test prepared by an outside agency seldom, if ever, perfectly fits the curriculum of a particular school. In interpreting test results, differences between the objectives and content of standardized tests and the objectives and content of the curriculum of the school must be taken into account.

When tests of mental ability that yield intelligence quotients are used, the intelligence quotient of a pupil may vary as much as ten points, depending on the test used. Even if the intelligence quotient is obtained from such a dependable measure as the Stanford-Binet Scale, it is well to remember that an intelligence quotient is not a fixed and unchangeable attribute of the child; it is simply a number that represents a complex of native and environmental influences and may change significantly as the individual develops and new environmental influences are brought to bear on him.

A sixth essential is to place major emphasis on pupil appraisal, guidance, and development rather than on teacher evaluation. The emphases recommended are highly desirable for two reasons. First, teachers cannot be evaluated fairly by testing the achievement of

their pupils unless the administrator is willing to undertake a rigorous, thorough study in which all extraneous influences on pupil achievement are carefully controlled. Second, the centering of attention on pupil guidance will do a great deal to relieve the teachers' insecurity about tests and encourage them to avoid teaching for the tests and get on with the real business of instruction in line with fundamental objectives, letting the tests fall naturally into the year's work without effort to make special preparation for them. Teachers may thus discover for themselves that usually the best preparation for standard tests is vigorous pursuit of the regular course of study.

The last essential in the use of tests I shall mention here is the integration of measurement (I am thinking of both standardized and teacher-made tests) so closely with instruction and guidance that they are all of a piece in the work of the school. As Ben D. Wood has long urged: "Systematic testing and guidance should be an integral part of the whole school procedure from kindergarten through university and on into appropriate gainful employment in the work of the world" (7).

We have considered several contributions educational measurement can make to school administration, and we have listed some essentials for realizing these potential contributions. We come now to a major problem that is causing grave concern to many school administrators throughout the country: the growing number of testing programs. This problem has been developing slowly for several years, but it is only within the last year that there has been vigorous vocal recognition of it and a demand on the part of school administrators that something be done to relieve the situation.

The problem is the result of several circumstances. First, there has been a revival in test construction for school use, an enterprise which was virtually suspended during World War II. The products of these new test-construction efforts have only recently become available. Second, the number of applications for college throughout the United States has greatly increased, and test scores are one of the necessary bases for college entrance and placement. Third, there is

an imperative need to discover, stimulate, and train young people of scholarship caliber; test scores are an essential element in the identification and the screening of a greatly enlarged scholarship program. Fourth, the development of new electronic test-processing equipment has made it possible for test publishers and other organizations to offer not just tests, but low-cost, self-contained testing programs, which are just now being presented to schools. Finally, the National Defense Education Act and other sources are providing much financial nourishment for testing programs administered through the states, with the result that, in many schools, what was a small caudal appendage to the work of the school is developing into a large and vigorous tail, which, some persons think, is threatening to wag the dog.

These developments are not due to a planned effort on the part of testing people. They simply happened to come at about the same time, and school administrators are receiving the brunt of this fortuitous tidal wave.

Information as to what proportion of the schools in the United States are meeting this kind of problem is not available. Presumably, many schools that have no testing program of their own are not adversely affected by testing programs proposed from the outside. But many schools that have well-developed, within-school testing programs say that they are finding the pressure of outside testing an increasingly heavy burden.

The seriousness of the situation is evidenced by the interest taken by several national organizations. The American Association of School Administrators, the National Association of Secondary School Principals, and the Council of Chief State School Officers have found it advisable to undertake a study of educational measurement throughout the country. Various test publishers and other national testing organizations have let it be known that they welcome this study and have offered their full co-operation. Ralph Tyler and other experts are serving as consultants.

Complaints on the multiplicity of testing programs offered to the

schools fall into three groups. First, it is said that testing programs are competing for the student's time and taking time that ought to be given to instruction. Any testing program takes some time away from teaching. One cannot say exactly how much time should be given to standardized testing during a school year. A comprehensive within-school testing program may take as much as four days of a student's time—two days in the fall and two days in the spring, or at least it may interrupt his regular schedule for that amount of time. Four days out of a school year of at least 180 days—one forty-fifth of the time—could hardly be regarded as excessive, if the tests are used effectively to enable teachers and counselors to do a better job. But as testing time is increased, a point is reached where the amount of time thus used cannot be justified. The main function of the school is learning, although guidance is a closely allied function. Nothing must be allowed to take time from these functions unless it is clear that the time so used actually contributes to them. It is a nice administrative problem to decide when the right balance is reached.

A second complaint is that so many different testing programs are now offered that schools are confused about their relative values and uncertain as to which programs to choose.

The availability of many different testing programs is not inherently bad. In fact, it is consistent with the American belief that free competition promotes improvement of the product and is potentially beneficial to the consumer. But many schools do not have adequate resources of their own for deciding which testing programs are best suited to their purposes, and schools able to make such decisions are not always free to decide because of outside pressures.

This brings us to the third criticism that testing programs offered to schools on a state-wide or nationwide basis interfere with local control. For instance, where two national college-entrance testing programs are available, the school administration may not be free to decide that the students should participate in one of these, or in neither, because parents, in their apprehension over the admission of their children to college, may insist that their sons and daughters

be given an opportunity to record their abilities on both sets of tests. Moreover, parents may put pressure on the school to prepare students specifically for these outside tests.

Most of the current criticism of educational measurement among school administrators seems to boil down to an unfavorable reaction to the various entrance and scholarship testing programs, which, they feel, are being imposed from the outside. Let it be clearly understood that these testing programs form only a small fraction—probably not more than a tenth—of the total volume of all tests administered in our schools each year. The great majority of the tests given are used in the schools' own testing programs which have grown up during half a century because schools believe they are getting something of value from the results. If the contributions of measurement to administration and to instruction and guidance, as mentioned earlier, are valid, then it would seem that there should be no wholesale condemnation of measurement but that solutions should be sought within the framework of the more specific sources of difficulty.

How can we alleviate the difficulty? In view of the broad attack on the problem which has been initiated by the American Association of School Administrators, the National Association of Secondary School Principals, and the Council of Chief State School Officers, and in which other groups are co-operating, it would be foolhardy for any one individual to say he has some answers. However, at the risk of seeming more precipitous than the angels, I would like to suggest tentatively some directions that the solution of the problem may take.

The solution has both long-term and short-term features. Fundamentally, it is a long-term problem, but administrators may take certain steps to relieve what in many places seems to be a fairly serious emergency. Some of these steps follow:

1. Re-examine the school's own testing program. Do all the tests being administered actually contribute to the purposes of the school? Are the tests being given at the most appropriate times, such as at the point of transfer from one school unit to another? Is there duplication? Are the same or similar abilities being tested with tests that

bear different names? Is each test score being used for several purposes as it should be?

2. In a particular area of outside testing programs, insist that one test serve the purpose or that equivalent scores be set up for the tests used so that scores on one test may be translated into scores on a similar test and thus used for reporting purposes. For the purpose of awarding scholarships, for instance, one test might become the only test used. All individuals, organizations, companies, and other groups that have scholarships to award might have access to the scores on this examination as one basis for their decisions. Or, in the field of college entrance, there ought to be equivalent scores for the College Board Scholastic Aptitude Test, the American College Testing Program battery, and other tests widely used for entrance purposes. If this recommendation is followed, the taking of one or another of these tests would make it possible to report to all colleges in the same terms. The student's results could be used regardless of which test he took and which test a college customarily requires for admission. This suggestion is made, notwithstanding the technical problems involved.

3. Similarly, to reduce the amount of duplication in testing and to make reporting of scores more meaningful in all fields of study and at all levels, urge test publishers to co-operate in setting up a national system of norms so that scores from several tests in the same field would be comparable. Such a procedure has long been advocated by various test specialists, and it will soon be feasible at the high-school level through the equating of various series of tests to the tests of the National Talent Study (Project TALENT). With the financial support of several governmental agencies, these tests were administered in March, 1960, by the American Institute for Research, under the direction of John C. Flanagan, to a national sample of about five hundred thousand high-school students.

The full solution of the problem of multiplicity of testing programs must be sought on a long-term basis, however. It will be found, not through less testing, but through within-school testing spread through a much larger number of schools than now administer tests

regularly. As long as many schools have no testing programs of their own, it would be contrary to the public interest to discourage nationwide testing programs for discovery and education of talented young people. We must ferret out and develop our full national resources of talent. Paradoxically, the first requirement in reducing the multiplicity of testing is for every school in the country to adopt a systematic testing program of its own.

A second requirement is for every school to maintain a cumulative record of test results and other data in terms of defined norms understandable to all. It is impossible for a school to carry on an adequate testing program and to take full advantage of the multiple uses of test results without a well-organized cumulative record.

A third requirement is for rapid, inexpensive processing and reporting of the cumulative data. As pointed out in a recent meeting of the Educational Testing Service Advisory Committee on Secondary School Tests, a committee whose members were appointed by the National Association of Secondary School Principals, this requirement can now be realized through the use of new electronic processing equipment (8).

A final requirement is to educate college admission officers and employment officers in business and industry to an understanding and acceptance of cumulative record data that vary somewhat from school to school. This may be the most difficult task of all.

Admittedly, this suggested long-term solution is a statement of an ideal which is far from realization at present. But if it can gradually be brought about, the need for outside testing programs will steadily be reduced and may finally vanish. The school's own testing program, fully under its own control, will then meet all measurement needs.

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Theory in Educational Administration

For the past two summers I have been abroad in the role of a professional American educationist, visiting my counterparts in Western Europe and the Soviet Union. During my travels I came to dread the inevitable question: "What are the most exciting developments in educational theory in the United States today?" I had to admit that we simply are not producing educational theories with originality and power as we did during the Progressive era. In all honesty, I was forced to add that at present the field of administration has the most sophisticated body of literature that is clearly theoretical.

This response was surprising, in some cases downright offensive, to my colleagues in other countries. To one who understands the social and historical context of American education, however, there is nothing incomprehensible in the appearance of works of resourcefulness and power devoted to theory in educational administration. I should like to explain here my understanding of how and why this movement toward a theory of educational administration has come about and to criticize some assumptions in recent formulations of administrative theory.

I suspect that, even if my efforts at an explanation of this phenomenon were successful, my colleagues abroad and in certain academic disciplines would not give over altogether their hostility toward the whole idea. But that is understandable also.

The current impetus toward theory in educational administration must be understood first in relation to the unique role occupied by the administrator in American education and, indeed, in all aspects of American life. But let us consider education first.

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At least since the Louisiana Purchase in 1803, the United States has stood in desperate need of a national system of schools. The vast expanse of the country, the heterogeneous character of its population, the high rates of geographical and social mobility, the constantly changing technology of agriculture and industry, the spreading suffrage—these are merely a few of the many factors that demanded a common basis of skills, attitudes, and knowledge among the American people. For well-known historical reasons, the federal government could do little to insure this common education. It is not too fanciful to say that in the Civil War the federal government was forced to preserve its unity by arms because the Constitution had denied it the use of schools.

Since the Civil War, we have created what is, in effect, a national system of education without violating the principles of state sovereignty and local control of the schools. Today a pupil can move from Arizona to Maine and require very little educational adjustment to the new school system. There are, of course, enormous differences in the quality and effectiveness of education in this country, but the goals and the structure of deliberate education have come to be, as they simply had to be, fairly well standardized across the nation.

In creating and maintaining this basic unity in the nation's schools, administrative officials at all levels occupy a peculiarly sensitive role, one of mediation among the conflicting forces and demands that impinge on the day-to-day life of the schools. The details of this role have been the subject of several studies and need no further elaboration here (1). The significant point for present purposes is this: Administrators in American education have developed a sense of personal identification with the role of administrator, which is, at least in degree, quite unlike that found elsewhere in the world; and, in typically American fashion, they have established a series of voluntary and informal organizations to cement and extend that identification with the administrative role.

Attitudes toward this historical chain of events vary considerably. Arthur E. Bestor regards it as abominable; he labels the result "an interlocking directorate" of self-appointed dictators and blames it for

most of the ills (real and imagined) that beset today's schools (2). A somewhat different attitude may be noticed in this passage:

Administration thereby became, in effect, a necessary social invention, by a minority, to develop and effectuate under new conditions social values at least as advanced as those assumed in the formally constituted structure; the rise of the professional movement reflected the voluntary assumption of the task of trusteeship and responsibility for maintenance and advance of social values via the multiplicity of organizations and governing systems of the pluralistic society [3].

The attitudes are different, but the phenomenon designated is the same: a group of men (generically speaking, though the proportion of women is small) who have and feel a special responsibility for the continuously changing set of institutions that we call schools. In the absence of a national ministry of education in which policy decisions on education can be made through the usual political channels, in the absence of a stable and distinctive American tradition of schooling, this self-conscious minority group has been given (or has taken unto itself) the obligation of translating into practical school programs the ever changing demands for education from an ever changing national culture. So expressed, the task is a heroic one; it justifies, perhaps, the otherwise grandiose title, *Educational Administration as National Policy*, that Jesse Newlon gave to his enormously influential book of the 1930's.

This first consideration, that of the unique role of administration in American education, is a necessary condition for the appearance of administrative theory, but it is not sufficient to produce this phenomenon. Let us consider next the character and, more especially, the manner of training of the men who assume the role of administrator.

While it is no doubt true that the school administrator is less adequately rewarded in money and prestige than his counterpart in business or industry, it is also true that, in the very broad occupational field we call *education*, only administration offers opportunity for the salary and, more in point, the exercise of power that would attract large numbers of able and ambitious young men.

The stereotype of the educational administrator is a fairly clear one: he is physically larger than the average teacher; he was likely an athlete as a youngster. (If he is an older man, he was probably a coach before he became an administrator.) He is socially gregarious and is poised and comfortable in the widest range of social intercourse. He is highly verbal; he readily and unconsciously takes on the latest nuances of speech—luncheon club clichés, smoking room stories, and pedagogical jargon. He has enormous energy and capacity for channeling that energy toward defined tasks. This last quality implies, and the stereotype admits, an ability to find relaxation and recreation in definite and strenuous avocational pursuits. We all know administrators who are exceptions to this stereotype in one or more details; we know also that the administrator in the field who is too different from this picture is likely to find his job uncomfortable.

Does this portrait describe a person who is likely to have the imagination, the scholarship, and the detachment to be a creative theorist? Not as it stands, no. But notice. In the United States we have made of educational administration a university discipline, as indeed of what haven't we? For the upper reaches of opportunity in educational administration, a doctorate from a recognized university is virtually requisite. Whether this academic training does the practicing administrator sufficient good to justify the time and effort spent for it is a moot question.

What is unquestionable is that the man (especially the younger man) of the sort described in our stereotype, on becoming a professor of educational administration, usually adopts the values of the academic community, sometimes with a vengeance. He becomes terribly dissatisfied with well-meaning but meaningless ideology as the content of his courses (4). He rejects the cookbook approach to practical problems. He comes to demand the same standards of research and validation for his lectures and publications that are accepted in other disciplines. And being the kind of person he is (remember that the rule is correlation, not compensation in range of abilities), he can not only secure funds and organize trained minds

from other disciplines to carry on research, he can also participate as a creative scholar in research and theory construction (5).

At this point, the story of theory in educational administration begins to overlap similar stories in other fields of administration. The "Managerial Revolution" in business and industry created a class of business administrators conscious of their unique role in American life, and schools of business administration then ceased to be mere trade schools for accountants and clerks. The New Deal demanded and created an entirely new kind of public administrator, and departments of political science across the country found that the study of the history of political philosophy from Aristotle to Woodrow Wilson was no adequate training for those who would serve in the expanding departments of the federal and state governments (6). Arthur F. Bentley's long-neglected *Process of Government* was taken from the shelf, and its rigorously empirical standards of research and theory came to dominance in the major graduate departments of political science. Just when I do not know, though I imagine it was belatedly, the armed services came to recognize that an officer is more than anything else an administrator, and they have poured prodigious sums of money into research on the process and effectiveness of administration. The administration of hospitals and the administration of social work have become objects of academic teaching and research. Are courses being given in the administration of philanthropic foundations? If not, they soon will be, without question. And when they are, the process will be repeated: those who teach the courses will not be satisfied merely to report what practices were followed in the administration of Millionaire X's bequests; they will seek for general principles of administration per se that can be applied in whatever situation the student may find himself.

The second condition for the upsurge of interest in theory of educational administration, then, is that the field attracts able and ambitious men and trains them in an academic environment, where the superior ability and the ambition of their teachers are naturally turned to academic concerns, that is, research and theoretical concerns. When teachers of educational administration look over departmental

fences, they find that they share many common, if not identical, concerns with those engaged in research and theory construction in other fields of administration.

These circumstances provide the appropriate background for interesting developments, but the appearance of the distinctive approaches to theory we have seen in the last five years requires still another condition, one that can be only mentioned here. The study of administration today lends itself quite naturally to the application of some of the most creative branches of basic research and theorizing of our times, particularly functional social analysis, small-group behavior, communications, and decision-making.

These newly emerging disciplines provide tools for research and theory in administration in a sense quite different from the sense in which, say, history or political philosophy provide theoretical bases for educational administration. From history or political philosophy, one may draw certain general statements which are regarded as true. One may then ask: If this statement is true, what does it imply for the administration of education? The implications drawn may be wise or foolish, depending on who draws them. But they are not the kind of statements that can be formulated as components of a theory of administration *per se*. Such implications are more than likely normative. For example, if the American tradition of church and state relations in education is one of increasing separation and freedom from religious sanctions, then administrators ought, that is to say they are normatively obliged, to guard against attempts by any church group to encroach on public school money and time. Or again: If a democratic philosophy of politics requires that those affected by a decision have a voice in making that decision, then administrators ought, that is to say they are obliged, to provide ample opportunity for discussion of all policy questions. These implications are stated much more baldly than they would be in usual discourse, but the normative character of the logic is clearly representative.

Note that in strict logic, the so-called implications drawn here are not valid implications at all. The fact that our historical tradition

has been of a certain character does not, strictly speaking, imply that administration ought, in the moral sense of *ought*, to follow a particular course of action. Perhaps the morally correct thing to do is to change this tradition. Nor does the fact that we use the word *democratic* to describe certain kinds of administrative behavior and not others strictly imply that administrators ought to exhibit the behavior so described.

While these implications are not rigorous syllogisms, they are commonsensically, contextually reasonable arguments. But for theory, in the sense the term enjoys here, this contextual reasonableness is of no value at all. A theory must imply consequences in the way proof implies a theorem in Euclidean geometry. This is a revolution in the way we are using the term *theory*, but that is unavoidable if the precise scientific meaning of the term is to replace the loose common-sense meaning.

Theories in the scientific sense, especially those developed from the newer social disciplines I mentioned, cannot be used to draw normative and contextual implications. What they do, rather, is to provide a new language system for designating states of affairs found in the administrative process, and they provide hypotheses, already tested in other situations, that states of affairs so designated follow a predicted sequence, all this with a determinate probability. Propositions formulated in the language of, say, communications theory are subject to precise logical relations; such propositions do yield implications in the logico-mathematical sense, this more rigorous sense than the sense illustrated in the examples of intuitive or contextual implications. This is to say that propositions designating aspects of administrative process or behavior formulated in the language of these newer disciplines can be formed into theory, in the restricted scientific sense of the term. There are obvious limitations to theory in this restricted sense, but the point here is a simple one, namely, that attempts to construct precise research designs and elegant theoretical models in administration today are vastly facilitated by the presence of basic theoretical language systems that were virtually unknown

twenty years ago. This is one of the primary conditions for the movement toward administrative theory (7).

To summarize quickly, I have argued that three conditions must be understood if we are to account for the rapid rise of interest in basic research and, more particularly, theory construction in educational administration. First is the unique place of the administrator in developing a national system of education in this country and the identification with the role of administrator by those who occupy positions of authority and responsibility in our schools. Second is the fact that the professional training of administrators occurs in an academic environment where able and ambitious men are forced to come to terms with academic standards of validity and elegance in what they teach and write, this condition being true not only of education but of all fields of administration. Third is the appearance of powerful theoretical models in other disciplines that can be applied, at least in principle, to various aspects of administration.

One intensely subjective factor also seems relevant to understanding the matter at hand. For reasons that defy my comprehension, American society today seems obsessed with the notion of leadership. Witness, for example, the shift in the content of fiction concerning World War II. The first batch of novels and films dealt with the GI stumbling through mud, danger, and boredom. The more recent have given increasing attention to "Command Decision," the psychological and social conflicts of the man who must order other people about. Or turn to the business novel. The old formula for this genre was simply rags to riches or vice versa. Today the point of focus is the man at the top who strives to preserve his self-integrity in the face of the demands of some organization (8). The novel of academic life is a parasitical form in the United States, but such examples as we have seen recently, those of Carlos Baker and Stringfellow Barr being typical, concern themselves almost exclusively with the nature of academic leadership (9).

These scattered instances prove nothing, of course, yet there is

something about the current intellectual climate in America that makes social scientists from many fields willing, indeed eager, to collaborate with practical administrators in developing research and theory; that makes philanthropic foundations, universities, and the federal government support this enterprise with comparatively ample funds; that makes teachers of administration desperately anxious about the content of their teaching and writing. In this climate, theory of educational administration becomes relevant to a deeper, albeit nebulous, social need: that of understanding the nature of leadership and authority in putatively equalitarian culture.

If my interpretation of the interest in theory of educational administration is correct, this phenomenon is rooted in fundamental social forces and is not likely to disappear with the crowing of the cock. It becomes important, therefore, for all educators to understand what is going on and to seek for an intelligent attitude toward it. For, as I hope will be clear, the growing importance of theory in administration is not something toward which one may be comfortably neutral.

But, personally, I find it difficult to say what an intelligent attitude would be. On the one hand, there is inherent interest in the technical problems of constructing a theory of educational administration, theory in the elegant sense that the writers whose works I have cited use the term. On the other hand, the very conditions required for the deliberate use of administrative theory destroy many of the values for which I, among others, chose teaching. The fault, if such it is, lies less with administrators as people than with the fact that education is belatedly being drawn into the contemporary world.

Let us look at the technical core of the problem. I said that theories in communications, decision-making, small-group behavior, and functional analysis of institutional structure provide intellectual tools for the construction of theory in administration. This is true, but no one of these other theoretical fields automatically supplies a theory of administration. In principle, one can describe an administrative situa-

tion in the language of any theory, just to be extreme, say, in the language of physical mass and velocity. Such a description would be a purposeless tour de force. The reason for its lack of purpose is quite obvious: One cannot describe in the language of physical theory those features of an administrative situation that are genuinely relevant to it as an administrative situation.

The same is true, though not so obviously or so completely, of a description of an administrative situation in the language of any of the other fields mentioned. The difference between the latter and the language of physics can be summed up simply: In the language of, say, communications theory, one can say some very enlightening things about an administrative situation—its inputs, encoding procedures, its sources of noise, and so on—but at the cost of ignoring other features that are quite important to it as an administrative situation. Described in the language of physics, the situation ceases to exhibit any of the features we think relevant to it as an administrative situation.

What I have said about communications theory applies to all specialized theories. One can, for example, design research that treats an administrative situation purely as a system of interpersonal relations, but, in this research, one could not study the legal and moral framework of administration. One can describe a particular administrative unit in education as a system of formal and informal social structures having certain relations to other social structures around it; in this language, one can say some things about the legal and moral framework of the school, but one cannot use such terms as *input*, *encoding*, or *noise* except in non-theoretical senses.

What often happens is that, wanting to say a great many different kinds of things about a situation, some of those who write about administration borrow terms from various theories and then use the terms in non-theoretical ways. In itself, this practice is perfectly unobjectionable, but it must not be confused with theory construction in the precise sense. To use terms in their precise theoretical form means that one cannot say some things he might wish to say; the

consequent advantage is that he can say what he does say with such exactness that he can deduce from his statements their precise logical consequences. To express the idea in another way: By using precise theories and using them precisely, the student of administration can gain intellectual control over his material.

Of all the specialized and precise theories that are to be found in our cultural milieu, theories of decision-making seem to me to have the greatest potential for educational administration. But the purely technical problems of constructing a theory of administration in the language of current theories of decision-making seem to me completely overwhelming. These difficulties are partially concealed by the model of decision-making chosen by Griffiths and others who discuss administration in these terms.

The model most frequently cited is that of Irwin D. J. Bross (10), who presents a beautifully lucid and logically tight analysis of the decision-making situation when it consists of the following elements: a person (in almost the legal sense, which would include a group, a corporation, or the like), call him B; with certain purposes, $P_1 \dots P_n$; and certain alternatives to action, $A_1 \dots A_n$. (We may consider purposes and alternatives as finite in number, though strictly speaking they are not.) The decision situation is one of gathering evidence in order to choose rationally among the alternatives in such a way as best to achieve purposes. But if B had to delay action until he had all the evidence concerning all the alternatives, he could never act at all, never achieve any of his purposes. The problem, then, is to design an evidence-gathering procedure in which, first, duration and expense of research for any given decision are rationally determined by the importance of that particular decision to the whole sequence $P_1 \dots P_n$ and, second, one of the alternatives $A_1 \dots A_n$ emerges as a rational choice. These conditions require that the evidence-gathering procedure be related to the kind of outcome sought, whether one is risking all for the best outcome or trying to minimize the risk (even if this means giving up a chance at the maximum good) or trying to balance these, seeking the so-called mini-max solution.

In its details, this mode of analysis is quite enlightening, even when we cannot quantify, as the analysis would seem to require, the probabilities of outcomes from alternative courses of action or give a numerical value to the relative importance of any given decision in terms of the purposes. But the real trouble with Bross's mode of analysis is that it simply does not apply to the kind of decision situations that educational administrators face, though the approach applies beautifully to certain decisions that might arise in industry.

Suppose an industrialist (call him Mr. I) is deciding whether to institute a particular system of quality control. Mr. I's decision situation has two features that would not ordinarily be found in a decision situation in educational administration. First, Mr. I has no real problem in defining the purposes of the decision on quality control; the goal is to get the highest possible profits for his concern. Second, with Bross's mode of analysis, Mr. I can consider the whole operation of his concern as if it had only one agent for purposing, inquiring, choosing, and acting. The agent is Mr. I himself. Actually a number of agents are involved, but Bross's mode of analysis has not essentially falsified the aspects of the situation that are relevant to it as a decision situation by treating it as if there were only one agent in it.

Now neither of these conditions obtains for educational administration. The point may be made clearer by contrasting two familiar games. Bross's mode of analysis applies quite well to playing *solitaire*, in which we have a unified and simple purpose and only one agent. But the decision situations that are faced in educational administration are much more analogous to those faced while playing *poker* in a group composed of friends and enemies. In the *poker* game, purposes conflict. A player wants to win money, yes. But he does not want to win too much from his friends, and he does not want his enemies to be able to accuse him and his friends of collusion and thus break up the game. Obviously, since there are many agents in this situation, the decision of any one agent becomes a datum to which the others must adjust if the system as a whole—that is, the game—is to be maintained intact.

An analysis of the *poker-game* decision situation that has the ele-

gance and simplicity of Bross's model is not available now, nor will it ever be. What I have to say about a situation of co-operative competition is, in a quite attenuated sense, analogous to the language of theory of games, but the task of constructing a logically tight theory in these terms is entirely beyond my powers, which is not to say, of course, that persons whose works have been cited here will find it impossible (11).

Despite its difficulties, decision-making by games theory seems, in principle, to be the field that offers the greatest potentialities as a basis for theory construction in administration. The administrative unit in education is defined as in a state of co-operative competition with a finite number of competitors. The purpose of the administrative unit is to maintain or to improve its position relative to its competitors, and this purpose implies maintaining the integrity of the larger system in which the competition occurs. This formulation of purpose does away once and for all with the external definition of the distinctive function of the school in comparison with other institutions.

To use theory of games requires that, for any administrative unit, one can state a rank order of preference for alternative outcomes of the next move in the system, the next after that, and so on. From a standpoint outside the administrative unit, one may predict that for any move inside the unit a certain movement up or down in the preference scale will occur. Any move within one unit will set a new decision situation for all the other units in the system; this means that there is no best decision for an administrative unit, though there is a range of best decisions for the system as a whole.

Even though one cannot specify the best decision for the administrative unit in education, one can easily see that the worst alternative is the dissolution of the administrative unit. When specifying preference orders for consequences of moves, this alternative comes at the very bottom. But what constitutes a best move in the system? Consider a community in which a new school budget is being proposed. The worst alternative is no money at all. But what is the best? One in which the school gets all the money in the community? Of

course not. The "best" here has to be defined as a range in which the situation of co-operative competition among all the different units can be maintained. The proposal of a school budget is a move in the system. Many other units in the system must adjust their moves to the size and character of a school budget. For the school, as one administrative unit in a system of a local community, certain outcomes can be specified as preferable to others. An outcome which sees a reduction in the amount the community spends on certain vital health services is less preferred than, say, an outcome that sees a reduction of the amount spent at the bowling alley, even though the budget of the school is not changed by either alternative. (Technically, a preference order ranks alternative states of the total system and not solely positions of one unit in the system.)

If we consider the school as an administrative unit in this sense, we must still make empirical predictions that are not deducible from the theories of decision-making. For example, we may confidently predict on common-sense grounds that if an administrator continually issues unpopular decrees without consulting those affected by them, he will create disaffection in his school system. But notice this: Our model of decision-making gives us a theoretical reason for saying that this prediction is relevant to administration of schools. Such behavior on the part of an administrator would constitute a move in the system of co-operative competition, and this move would likely reduce the relative advantage of the school in that system. Thus predictions from other laws in the social sciences also acquire their administrative relevance from what they enable us to say about the probable outcomes of other moves for the preference orders of the school. In this way we can answer some of the familiar questions that are faced by every theory of educational administration: What behavior of the administrator is functionally diffuse, pertaining to him as an individual? What behavior is functionally specific, pertaining to him as an administrator? Behavior that makes a significant difference in the competitive position of the unit he administers is specific; the rest, diffuse. To what extent should the informal social

organization of the administrative unit be brought into congruence with the formal? To the extent that congruence is necessary to maintain and improve the position of the unit.

A theory elaborated in these terms would be far too cumbersome to be of use to the practicing administrator, at least for the immediate future. This is not, however, a crucial objection against any theory of administration. Despite John Dewey's oft-quoted remark about theory's being the most practical thing there is, we are all quite conscious of the fact that a practicing administrator's success or failure, measured by what happens to and within his administrative unit, is determined much more by his personal attributes than by the theory he espouses, if, indeed, he espouses any theory at all. (And please don't say that he has an implicit theory when you have already promised to use the word *theory* in its precise sense as a set of propositions having certain logical relations [12]. The expression *implicit theory* or its equivalent is then self-contradictory, and uselessly so.)

We assume that any administrator who goes through the formal and informal selection procedures that are already in use has learned to predict fairly accurately the effect of his actions on other people and on the immediate organizational system of which he is a part. It will be a long time before explicit theory will actually improve this learned ability. The requirements for theory construction are theoretical, or better, meta-theoretical. But this much can be said for the use of theory constructed along the lines indicated here. As we move, and inevitably we are moving, toward planning both internal and external strategies for educational institutions as a whole and not just for the local administrative unit, we will be less sure of the ability of the administrator to adjust his actions on the basis of his intuitions. As theory of educational administration is developed according to requirements of theory, a use for it will appear.

Aye, and there's the rub. In maintaining or possibly enhancing its position in comparison with other social institutions in an increas-

ingly tightly knit social system, the school is forced to adapt internally to moves made by its co-operative competitors. When, for example, Sarnoff states that N.B.C. (a broadcasting corporation) will give courses leading to a college degree by television, other educational agencies have to make suitable adjustments. Increasingly these adjustments will have to be made rapidly and, as happened recently in the USSR, in directions counter to existing educational trends. Such matters are not for argument; they simply are.

What is arguable is whether concomitantly increasing control by administrators is necessary or desirable. There is no doubt in my mind that the use of theoretically devised procedures of decision-making would enable the administrators to advance the standing of schools. But this step will require increasing centralization of decision-making and increasing control over employees' (that is, teachers') attitudes and morale. (The use of these models of decision-making also requires that the administrator adjust his own behavior closely to the demands of the organization. Theory does not play favorites; its use does not create sovereigns who are somehow exempt from its laws.)

Notice that these last remarks are rather easily seen consequences of the sketchy theoretical notions just introduced. They might be merely that, except that they fit so well with what is actually going on, namely, that education is becoming an increasingly important social affair, so important that sheer social necessity is forcing far-reaching changes on schools. Older views of academic freedom, the sanctity of the relation between the individual teacher and his class, a whole system of social control based on the transmission of skills by personal example, and the transmission of information and ideas by the printed word—all these are patently obsolete. Things would have changed more drastically ere now except for one thing: the schools employ over a million and a quarter people. It takes a very long time to change their behavior.

To use procedures for decision-making that will keep schools abreast of the times will require, at a not-so-distant future time, a

new kind of administrator and a new system of power and responsibility in which he can operate. The new administrator is one who can devise strategies for his administrative unit by applying theory in the precise, scientific sense of the term. The new system of power and responsibility will permit the administrative unit to move with speed and flexibility in the directions indicated by strategies based on theory. When that time comes, scientific theory of the kind presaged in the works cited here will, in all likelihood, be ready for use. Given current social trends, this time will probably, but unfortunately, arrive before the time for my retirement.

NOTES

1. Neal Gross, Ward S. Mason, and Alexander W. McEachern, *Explorations in Role Analysis* (New York: John Wiley & Sons, 1958); contains excellent bibliography. Also Willard B. Spalding, *The Superintendency of Public Schools—An Anxious Profession* (Inglis Lecture, 1953 [Cambridge, Massachusetts: Harvard University Press, 1955]).

2. Arthur Bestor, "Interlocking Directorate," in *Educational Wastelands* (Urbana, Illinois: University of Illinois Press, 1953), chap. 7.

3. Eugene L. Belisle and Cyril G. Sargent, "The Concept of Administration," in *Administrative Behavior in Education*, eds. Roald F. Campbell and Russell L. Gregg (New York: Harper & Bros., 1957). The sentence quoted is representative of the general tenor but not the rhetoric of this distinctively well-written and informative paper.

4. See Andrew W. Halpin, "The Development of Theory in Educational Administration," in *Administrative Theory in Education*, ed. Andrew W. Halpin (Chicago: Midwest Administration Center, University of Chicago, 1958), pp. 1-19.

5. This part of the story is fairly easily seen in the progression in the literature. In 1955 appeared a widely quoted monograph *The Use of Theory in Educational Administration* (Stanford University Press) by Arthur P. Coladarci and Jacob W. Getzels. The editor of the monograph series wrote, rather proudly, it would appear, that "neither author is an administrator nor cares to be one" (p. v). In contrast the Campbell and Gregg collection (*op. cit.*), published under the sponsorship of the National Conference of Professors of Educational Administration, is written almost entirely by administrators and aims definitely at putting "educational administration on a firmer professional footing by suggesting significant research directions and the next steps in theory building" (p. x). The Halpin volume (*op. cit.*) grew out of a seminar spon-

sored by the University Council for Educational Administration and the Midwest Administration Center. Its contributors represent several disciplines, and the chapters by administrators give nothing in scholarliness to those by such eminent social scientists as Talcott Parsons and Carroll L. Shartle. The recently founded *Administrative Science Quarterly* provides a forum in which educational administration will undoubtedly have an increasing voice. In comparison with other behavioral sciences, educational administration will both a borrower and a lender be.

6. Dwight Waldo, *The Study of Public Administration* (Garden City, New York: Doubleday & Co., 1955).

7. It must be understood that the writings cited do contain explicit recognition of the logical requirements of theory in its scientific sense. See especially Daniel E. Griffiths, *Administrative Theory* (New York: Appleton-Century-Crofts, 1959). Griffiths and Halpin (*op. cit.*) adopt the logical empiricism of Herbert Feigl—the hypothetico-deductive model—as the meaning of “theory.”

8. Daniel Seligman, “The ‘Business Novel’ Fad,” *Fortune*, LX (August, 1959), 104.

9. Stringfellow Barr, *Purely Academic* (New York: Simon & Schuster, 1957). Carlos Baker, *A Friend in Power* (New York: Charles Scribner’s Sons, 1958).

10. In *Design for Decision* (New York: Macmillan Co., 1953). Compare Griffiths, *op. cit.*, pp. 104 ff.

11. For an interesting beginning in the simplest sort of co-operative competitive situation, see R. B. Braithwaite, *Theory of Games as a Tool for the Moral Philosopher* (New York: Cambridge University Press, 1955). A review of the literature and some original research understandable with a minimum sophistication in mathematics is found in R. Duncan Luce and Howard Raiffa, *Games and Decisions: Introduction and Critical Survey* (New York: John Wiley & Sons, 1957).

12. In chapter 1 of *Administrative Theory in Education* Andrew Halpin quotes with obvious acceptance Herbert Feigl’s definition of theory: “a set of propositions may be called a ‘theory’ . . .” (p. 6). He goes on to say that “effective administrators have invariably based their decisions upon some kind of theory of administration” (p. 11). But an implicit proposition (or set of propositions) is a contradiction; a proposition must be put forth (*pro+ponere*) in language in order to be anything at all. Yet surely he cannot mean that successful administrators have based their decisions on theories in the explicit sense. This is obviously not so. Hence we must conclude that, in speaking this way, Halpin was merely repeating an outworn cliché.

The Fate of Postwar Educational Reform in Japan

After 1945 all aspects of Japanese society were subjected to sudden and profound changes. In what may be regarded as a nationwide social experiment, education was transformed, "democratized" in minute detail by the occupying power. The tragedies that ensued stem from the fact that these reforms were imposed without due regard for Japanese culture and social structure. It was as if a utopian dreamer forced a carpenter to build a house according to his dream blueprint.

Two basic social functions of education—really the same function—are the individual's assimilation of his society and the society's assimilation of the individual. But a society is made up of many sub-societies, each of which educates the individual in its distinctive way. These influences may be co-ordinated, or they may conflict. Moreover, the tie between person and society varies with the status of the individual and the structure of the society. These complex processes were exemplified in postwar Japan.

The official educational mission from the United States submitted its first report in March, 1946. The report radiated good will, expressed the democratic spirit, and revealed many keen insights. But it was written in three months immediately after the war, amid chaotic social events and remnants of ultra-nationalism. The mission was unable to appreciate the historical necessities that had shaped

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Japanese education after 1872. It had had no opportunity to observe the schools going about their tasks in a normal atmosphere. Working under these handicaps, the mission proposed six major reforms:

1. Shift from dual to unitary system. Before the war Japanese children attended a common six-year primary school, after which they divided into two streams. Prospective leaders attended a five-year middle school, a three-year high school, and a three-year university. Other children attended a two-year senior-primary or a five-year vocational school. After the reform there was a single stream for all children: a six-year elementary school and a three-year compulsory junior high school, plus a three-year senior high school and a four-year university course.

2. Extension of compulsory education. Before the war school attendance was compulsory for eight years; it is now compulsory for nine years, and education of the handicapped is obligatory.

3. Introduction of coeducation. Traditionally the two sexes were taught separately, but girls had limited opportunities for training in higher institutions. Coeducation is now practiced at all levels, and the doors of the higher schools have been opened to girls.

4. From centralization to decentralization. The higher schools had been built by the central government, and the lower schools grew up in response to its edicts. Virtually all aspects of education were closely supervised by the Ministry of Education. After 1947 the controls of the Ministry were sharply limited: authorized textbooks were abolished, elected school boards were introduced and given wide authority, and teachers gained much autonomy.

5. Encouragement of permissiveness. The traditional pattern included drill, discipline, recitation, memorizing, and indoctrination; the classroom was teacher-centered and textbook-centered, with little heed paid to individuality, creativeness, or spontaneity. This pattern was drastically reversed by the reform. Social studies replaced history, geography, and ethics. Extra-curricular activities, group methods, and guidance were encouraged.

6. Reform of the language. One of the heaviest burdens of pupils

who attended the prewar schools was mastery of complex usage and the innumerable characters of the Japanese language. In recent years much effort has been devoted to simplifying the language.

The 1951 peace treaty has not been followed by any drastic changes in school organization, but there have been many changes of substance. The 6-3-3-4 system has been retained. Japan has one of the longest periods of compulsory education anywhere. Virtually all children attend during the compulsory years, and standards remain high. The illiteracy rate is only 2 per cent. There are five hundred higher schools enrolling six hundred and forty thousand students. More than half the junior high school graduates continue into senior high school, and a sixth of the senior graduates enter the university. Certainly one legacy of the reform is the widening of opportunities for women, for the common people, and for the handicapped.

In many other respects the democratization aimed at in the reform encountered growing resistance, once the foreign controls weakened. There is increasing differentiation of preparatory and vocational courses even in junior high school. Approval and censorship of textbooks, revival of "moral" training, efficiency ratings of teachers, and a reaction against social studies are clearly underway. School boards are increasingly appointed instead of elected, and the authority of prefectural and Ministry officials is growing. These reactions are not a simple swing of the pendulum but express social needs.

The new system began in a period when Japanese finances were disorganized. The production index had sunk to 31 as against 100 in 1936, and per capita income was only 57 in 1946 as against 100 in 1936 (1: 17, 139). Even now, after the recovery of later years, Japanese incomes are far below those of Western countries. Efforts to expand educational facilities ran up against shortages of teachers, building materials, and equipment. Since 1,800,000 pupils finish compulsory schooling annually, addition of a ninth year led to great pres-

sure on space. Meanwhile evacuated children returned to cities, and the postwar birth increase had to be dealt with. In the Tokyo metropolitan area in 1948 only a tenth of the junior high schools had a separate building; others used elementary buildings in shifts. A thousand schools in the area had been damaged by bombs (2). Even today the typical teacher in Tokyo has fifty-eight pupils in his or her class (3: 13). Fortunately only 13 per cent of the teachers of compulsory classes are non-graduates of higher schools (4: 84). Legally, local boards are responsible for school expenditure, but inevitably the national government has assumed much of the financial burden, its share now being 44 per cent of the total. In 1957, 5.1 per cent of the national income was spent on education (4: 40). There are also heavy costs for individual families in the form of donations for buildings, equipment, textbooks—constitutionally, these are all free—averaging thirty-three dollars per pupil (1: 191). These financial obstacles go far to explain the new pressures for centralization, the lagging equalization of opportunities, and the lowering of achievement.

When only a few children continue in school, it is possible to provide generous facilities, and the selected children can be expected to display high academic performance. No system of mass training can match such standards, though the average level of training may nonetheless rise. In some manner homogeneous education at elementary levels is always balanced by differentiation and specialization at higher levels. An underdeveloped society that is striving to overtake more advanced societies usually puts emphasis on training an elite to manage the assimilation of foreign culture.

After Japan entered into world society in 1868, the government founded the Imperial University to train leaders, officials, and technicians. Though opened in 1881, this university was an offshoot of Shohei-ko, which for three hundred years had been the highest school for samurai—feudal knights. After the victory over China in 1896 education became more nationalistic. Highly selective schools were

established for the elite and compulsory schools for the common people. The higher schools trained the children of the elite, but they also introduced new elements into the elite.

Given this firmly rooted tradition of dual education, it is not surprising that the postwar signs of falling school achievement gave rise to alarm. National achievement surveys begun in 1956 revealed that secondary-school achievement was about one grade behind the prewar level (5). Most of the present elite were trained under the old system, and they are urging differentiation into college preparatory and vocational courses from the ninth grade. Business leaders also are critical.

As in most other countries, vocational education has enjoyed an ambiguous place in the formal school system. It is in origin different from primary education, which was intended to unify the people, and from higher education, which intended to assimilate and to create a higher culture. Both primary and higher education enjoy a firm ideological, academic, and universal basis; but vocational education originated in more practical and specific occupational milieus. It began as private or corporate training, not public or national, and its typical form was apprenticeship.

Before the war Japan had two kinds of vocational training above the six-year elementary school. One route led through the five-year middle school and through the three-year high school to the three-year university for professionals. The other path led from the six-year primary school into a five-year vocational school, or a three-year vocational college, for technicians. Most children had only a two-year upper elementary school. After the six-year lower elementary school, the vocational training was highly practical. After the war the junior high school absorbed the upper elementary years, the first three years of five-year middle school and of the five-year vocational school—but thereby lost vocational training because of its general character. Vocational training is now given in the three-year high school; general achievement here is now a year behind the

prewar level, and vocational training has declined two years. Vocational colleges, moreover, have been consolidated into four-year universities. They absorbed a strong academic flavor (and a more elite clientele) and came to be called universities (*daigaku*), with a loss on the vocational side. Under German influence, Japanese universities have had a kind of contempt for practical training. There is now a vacuum at both secondary and higher levels of vocational training. Demands by business leaders for a differentiated vocational college (*senka-daigaku*) beginning with the ninth year cannot be viewed as mere reactionary nostalgia.

The roots of the Japanese bureaucracy or civil service go back at least four centuries. But if we take up the story with the Restoration of 1867, we find that most of the former ruling classes continued to enjoy high rank in the new regime. As samurai, or feudal knights, they were highly trained in bureaucratic manipulation. They first built the Imperial University to train their successors and then the appropriate preparatory secondary schools and middle schools, thus always building from the top down. For the populace the elementary school was built first, and gradually its years were prolonged as national power and needs grew. Since in the new nation almost nothing could be done without governmental support, officials had the highest prestige and the most generous privileges. It is from such a background that the leaders forced to carry out the post-1945 reforms came; one suspects that few of them were more than half-hearted in abolishing the source of their own prestige.

Before the war Japan had only six national universities, though there were many national one-faculty universities and private universities. The few entrants to the national universities were chosen as early as the end of middle school. There are now seventy-two national universities, including the less reputed former vocational colleges, which have attained, at least formally, the same privilege as the former national universities. The bureaucrats have bided their time in dissatisfaction and resentment, awaiting the moment to restore the cherished older system. Acceptance of the recent curtail-

ments of the American-sponsored postwar system has not been tardy.

One might expect the less privileged groups who gained opportunities in the first postwar reform to fight for their new-won gains. Few of them, however, are really aware of social complexities, and they have no tradition of forming or expressing their opinions. Submission has been customary, and training in self-negation, resignation, and deference has been thorough. The deeper feelings of the masses in all probability are receptive to the tendencies toward re-centralization.

Of fundamental importance is the strong desire the Japanese have for higher education. In 1957 half the graduates of lower secondary (nine-year) schools continued their schooling; this percentage is growing steadily. In 1949, 42 per cent of the graduates continued formal study; in 1952, 48 per cent; in 1954, 51 per cent; and in 1957, 51 per cent. A sixth of the graduates of upper secondary schools undertook higher education, but this percentage has been declining. In 1949 it fell to 30 per cent; in 1952, to 22 per cent; in 1954, to 18 per cent; in 1957, to 16 per cent (3: 66-67). This decline is not a reflection of any diminished motivation for higher schooling but is due rather to the growing difficulty of getting into a higher school. One cannot precisely estimate the proportion of individuals who wish to enter a higher institution but fail the entrance examination; these candidates are known as *ronin*. It is certain that the number of *ronin* is rising rapidly. In 1950, 80 per cent of the applicants to higher schools had finished secondary school that same year, but by 1952 only 70 per cent had done so. On the other hand, the per cent of applicants finishing secondary school at least two years earlier had risen from 12 to 22.

It is especially difficult to enter the leading and most famous universities. For instance, the proportion of entrants into these universities who graduated in the same year from secondary school (that is, who were not *ronin*) was as follows in 1955: Tokyo University, 40 per cent; Kyoto University, 47 per cent; Hitotsubashi Uni-

versity, 33 per cent; and Tokyo Technical University, 42 per cent (6:78). More than half the entrants to these universities are *ronin*; they must wait and prepare more than a year before they are accepted. At present only about a fourth of all applicants (including the successful *ronin*) are accepted into universities. Some of the unsuccessful applicants finally get into a school that is their second or third choice. As competition intensifies, the pressures on preparatory schools rise. Because the entrance examination is decisive, the academic or college preparatory curriculums in secondary schools focus on these examinations. It is taken for granted that those who are to attend a university must begin their preparation early—even in elementary school.

There are two important implications of this situation. First, one would infer that prospective national leaders have a one-sided personality. To pass the examinations they must be oriented to individualistic or egoistic competition rather than to co-operation, and to scholastic achievement rather than toward balanced interests. They view education as a passport to the ruling class, not lifelong self-realization. Second, there is a chasm between university graduates and the common people, between preparatory courses and vocational training—hence the pressure for a dual system of schools.

Paradoxically, poverty contributes to this strong motivation for higher education. Of the ninety million Japanese living in an area the size of California, 39 per cent are employed in the secondary sector of the economy (manufacturing industries) and 36 per cent in the tertiary sector (social services). Only a third of the farmers devote their time solely to farming. Even in the non-agricultural sector only 44 per cent are employees; that is, there is much small-scale business. Ambitious youth seek positions in large business or in government, for which university training is essential. Bureaucratic qualifications tend to be formal and to rely heavily on formal education. It is easy to see why education, and higher education specifically, is widely viewed as the best channel of upward mobility.

The recruitment of students to Japanese universities is broadly

based, yet selective for status, as Table 1 shows. (Totals for daytime students only are shown. Public universities include communal, municipal, and prefectural.) The 1950 census reported the distribution of occupations in Japan to be as follows: professional 5 per cent; managerial 2 per cent; clerical 9 per cent; merchandising 12 per cent; skilled and semiskilled labor 21 per cent; unskilled labor, farmers, and fishermen 51 per cent (7: 74). As in other countries, the better educated groups (researchers and teachers, for example) and the more prosperous groups (managers, for example) have considerably

TABLE 1

DISTRIBUTION OF JAPANESE COLLEGE AND UNIVERSITY STUDENTS IN 1952 BY SEX, TYPE OF SCHOOL, AND OCCUPATION OF PARENT

PARENTAL OCCUPATION	NATIONAL		OTHER PUBLIC		PRIVATE	
	Per Cent Male	Per Cent Female	Per Cent Male	Per Cent Female	Per Cent Male	Per Cent Female
<i>Four-year universities:</i>						
Engineering, technology....	6	7	8	6	6	5
Research, academic.....	2	4	2	6	2	6
Teaching.....	11	21	7	10	3	7
Medicine, pharmacy.....	5	5	10	12	4	12
Management, executive.....	16	14	19	30	23	33
Clerical.....	21	20	21	18	17	12
Merchant.....	8	7	9	6	19	12
Farming, fishing.....	21	12	16	7	13	5
Technician.....	4	4	3	1	4	2
Other.....	6	6	5	4	9	6
Total enrolment (in thou- sands).....	135.4	17.6	14.7	3.3	146.8	26.4
<i>Two-year colleges:</i>						
Engineering, technology....			4	7	7	6
Research, academic.....			2	4	1	3
Teaching.....			5	11	4	8
Medicine, pharmacy.....			1	4	1	5
Management, executive.....			18	26	24	34
Clerical.....			17	16	16	16
Merchant.....			5	7	9	10
Farming, fishing.....			39	16	23	11
Technician.....			3	3	2	2
Other.....			6	6	13	5
Total enrolment (in thou- sands).....			2.6	3.9	8.8	23.5

more than their share of offspring attending universities. The manual laborers, listed in Table 1 as "Other," have only a small representation. The relatively large contingent in the national universities from lower strata reflects both lower cost and the operation of strict intellectual criteria for entrance. The two-year colleges recruit more

TABLE 2

RATIO OF FEMALE ENROLMENT TO MALE ENROLMENT IN
JAPANESE FOUR-YEAR UNIVERSITIES IN 1952 BY TYPE OF
UNIVERSITY AND PARENTAL OCCUPATION

Parent Occupation	National Universities	Other Public Universities	Private Universities
Total.....	.13	.23	.18
Engineering, technology.....	.14	.16	.16
Research, academic.....	.23	.69	.66
Teaching.....	.25	.33	.38
Medicine, pharmacy.....	.13	.26	.53
Management, executive.....	.12	.37	.26
Clerical.....	.13	.20	.13
Merchant.....	.12	.14	.12
Farming, fishing.....	.08	.10	.07
Technician.....	.11	.09	.10
Other.....	.13	.18	.12
Total enrolment (in thousands):			
Males.....	135.4	14.7	146.8
Females.....	17.6	3.3	26.4

broadly than the four-year colleges. Women are clearly handicapped in entering the four-year universities; in Japan, as in other nations, women students come from a more restricted and higher social background than men. As Table 2 shows, opportunities for women are distinctively good in families of professionals. Generally, however, both economic and cultural factors limit women's opportunities.

Japanese universities are very diverse in prestige. Of the five hundred higher schools the few most highly regarded are the old national universities with graduate schools. They have the most eminent professors and the cleverest students. There is also a distinctly Japanese element in this centralization: *Gaku-batsu* (clique

connected by school). Older graduates of each university protect and assist newer graduates at every opportunity. A particular school has hegemony among the staff in certain offices or schools, who exclude graduates of other universities irrespective of their ability. This is a subtle survival of feudalism amidst the rationalistic forms of bureaucracy. These differences in quality, certainly in repute, among universities appear to be widening. Two or three years of *ronin* life is not regarded as too high a price to gain entry to the preferred universities. These social and political forces penetrate the educational system, and they underlie the incessant clamor for reviving and strengthening the dual system.

In 1955 the Japanese Sociological Society conducted a national survey on stratification and mobility. When respondents were asked to specify the main determinants of social status, schooling was generally given priority especially among rural residents (7: 55). When the respondents were asked, "What do you think is the greatest obstacle for success in spite of one's ability and efforts?" schooling was mentioned first by 34 per cent, "connections" by 23 per cent, relation to superior by 14 per cent, wealth by 8 per cent, father's status by 7 per cent, the social system by 6 per cent, choice of occupation by 2 per cent (7: 58). It is clear that education is widely regarded as crucial for mobility.

That these perceptions are not entirely illusory is suggested by data on the educational background of a thousand men in the Japanese *Who's Who* of which 73 per cent have university education, 15.5 per cent have higher vocational education, 6 per cent secondary education, and only 5.5 per cent elementary education. In interpreting these figures (Table 3), one should keep in mind that 71 per cent of all Japanese aged 30 or more have only an elementary schooling, 22 per cent have a secondary education, 5 per cent have higher vocational education, and 2 per cent have attended a university (8).

Executives and heads of the Japanese business firms with a thousand or more employees have a highly selective educational background. Fifty-four per cent came from the national universities

(Tokyo, 28 per cent; Kyoto, 9 per cent; Hitotsubashi, 8 per cent; Tokyo Technical University, 3 per cent; others, 6 per cent); 16 per cent came from private universities; 20 per cent from vocational colleges; 5 per cent had only a middle schooling; 1 per cent graduated from foreign universities; for 4 per cent education was unknown (9).

Inherent in the postwar social situation in Japan was still another factor that influenced the present educational reaction. Defeat brought chaos to the value system. Authoritarian and feudal ethics, patriarchal nationalism supported by the constitution and the civil

TABLE 3

EDUCATIONAL BACKGROUND OF A THOUSAND JAPANESE MEN IN
Who's Who FOR 1956 BY PER CENT IN FIELD OF ACTIVITY

HIGHEST LEVEL OF SCHOOLING	Total	FIELD OF ACTIVITY			
		Govern- mental	Aca- demic	Eco- nomic	Political
Elementary.....	5.5	....	0.3	7.5	9.1
Secondary.....	6.0	....	0.3	9.1	8.2
Higher vocational.....	15.5	4.3	7.7	20.0	15.9
University.....	73.0	95.7	91.7	63.4	66.6
National.....	54.8	90.2	80.2	46.9	45.9
Private.....	15.6	5.5	8.7	15.3	20.7
Foreign.....	2.6	....	2.8	1.2	....

code, virtues of order and sacrifice, and Confucian contempt for material goods—all these ideologies had prevailed a long time and had been rationalized by education. Suddenly democracy, individualism, liberalism, and equalitarianism without any social basis poured into Japan and facilitated moral anarchy. At the time of the 1947 reform, economic and political disorders were rampant. The younger generation had no secure moral framework. Suicide, delinquency, and crimes were increasing rapidly. With the restoration of order, adult, but not juvenile, crime has diminished. Naturally there are widespread charges that the new school system and a pervasive skepticism and pessimism about the new school program are responsible for the undisciplined youth.

The significance of the tortuous events surrounding the effort to reconstruct the school system is perhaps not confined to Japan. The following generalizations may be hazarded.

Preoccupation with national unity and development is likely to be extreme in nations that begin development late. These aims entail a strong emphasis on education, but it is likely to be public and national education with marked centralization. Such systems tend to be planned, written into the legal code, and then put into practice. The first Japanese blueprint was copied from France in 1872; it proved to be too advanced, and another plan was begun in 1886.

The foregoing tendencies have wider sway if the newly born central government faces no opposed internal powers. In Europe rising states had to come to terms with churches, universities, cultural centers or circles, and economic agencies. The new Japanese state had an easier task, especially since in the new regime the old elite remained the ruling group. Many university plans were copied from Germany, but there was little temptation to accept the idea of academic freedom. At the same time, universities were greatly privileged because they were designed to train a certain kind of elite.

A dual system of education would appear to have a special appropriateness in this kind of situation. It is clearly imperative to train an elite capable of assimilating the desired foreign culture in order to speed development. The diligent government needs to recruit a capable bureaucracy quickly. Accordingly, higher institutions of education receive priority and develop rapidly. The demand for national unity and the need to draw the populace into the tasks of economic development impel the government to launch programs of mass schooling, but popular education is not welcomed by its intended beneficiaries so heartily as the elite accept the system of higher education. The public must come to see that it will gain from this educational system, which implies that the two systems of higher education and popular education must be connected at certain points. In Japan this occurred about 1919 when industrialization was advancing rapidly and opportunities for the masses began to expand rapidly.

Impatience for development and nationalism foster extreme centralization in the management of education. Japan was favored in this respect by its small size and its tradition of feudalism. Given this drive for national advance, national leaders would hardly be expected to intrust education on a large scale to private agencies.

The poverty of an underdeveloped nation is not wholly a handicap from the standpoint of education. Desperate poverty of the masses generates apathy, to be sure. But in those sectors of the population where a small economic margin can be won, if the mobility opportunities to be gained through schooling become visible, poverty itself provides a powerful stimulus to obsession with education.

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Book Reviews

Father to the Child by EVERETT S. OSTROVSKY. New York 13: G. P. Putnam's Sons, 1959. Pp. xviii+174. \$3.75.

This small but informative book deals with the effect and meaning of the role of the father in the lives of young children. As the subtitle, "Case Studies of the Experiences of a Male Teacher with Young Children" implies, the author takes the reader on a journey through the fascinating world of eight school children who lack contact, either completely or partially, with their real fathers. The journey is far from an unguided tour since the reader travels in the company of a skilled observer who is a well-trained and insightful interpreter of the multifaceted meaning of children's behavior.

Ostrovsky is both a child psychologist and an educator. He brings his training and clinical insight, along with a particularly clear writing style, to bear on a current issue in child-rearing and education. The issue: What can and do fathers contribute to the psychological development of their children?

One hesitates to use the term "social problem" in reference to the author's topic, since one usually thinks of social problems as vague and impersonal. Social problems seem to exist "somewhere in society." They are not often considered especially influential in the lives of individuals and seemingly apply only to large groups. Social problems belong to everyone and to no one. However, the father-child relationship in our society can rightly be viewed at least as an evolving social problem if not a current one. It is immense because it involves large numbers of individuals. A problem such as this is neither vague nor impersonal but, rather, as intimate and personal a problem as can be found. It is pertinent to a vast number of the individuals comprising society because the problem encompasses parents, educators, other professionals who work with children, and, of course, most of all the children who are affected by it.

In the four major parts of the book the reader is first introduced to the background and the implications of the problem. The author briefly discusses the background of the problem, the methodology used in the study, and presents generalizations concerning the effect of insufficient contact with adult males on the psychological development of young children.

Parts II and III contain the substance of Ostrovsky's presentation. Here he presents specific illustrations in the form of case studies. Although the eight cases are diversified, a major unifying theme supplies over-all organization to the cases and a minor theme binds the first four and the last four together.

All eight cases have in common some distortion of ideal father-child contact. In the first four cases, the father is physically present in the home but is absent in the sense that the child has very little contact with him. In the second four cases, the father is completely absent because of divorce or death.

Part IV summarizes and discusses the findings of the case studies. Some additional theoretical material mainly on personality development is introduced here because of its pertinence to the age level of the children studied. The final chapter in this section includes the author's recommendations concerning what might be done to insure healthy father-child relations.

It is important to point out that Ostrovsky is presenting cases of children who, diagnostically speaking, would be classified as normal. The extreme pathology that often characterizes studies of this type is absent in this book. The subjects are nursery-school children who exhibit emotional problems related to their lack of experience with adult males. The severity of these problems increases proportionately to the amount of this type of deprivation the child has experienced at this critical period in his life.

Also important is the fact that this presentation is not just a listing of child behavior problems that result from a lack of adult male companionship. Rather, it is a documentation of each child's successes and failures in his own attempts to resolve the undesirable behavior that accompanies such deprivation. Nor is Ostrovsky viewing the process with the eye of a detached observer. He is the father substitute, intimately involved in each child's problems. The children he describes are members of a nursery school in which he taught.

The author takes a constructive approach to the problem he presents. His recommendations for remedying the effects of father absence and for supplying optimal father-child relationships are both workable and sound. The obvious and most desirable solution is to remove the cause of the problem. In this regard Ostrovsky suggests that American fathers return to a more active role in the rearing of children. He argues that fathers should have intimate contact with their children at all ages and that these contacts should be more frequent than they now are in many American families. Since frequent and intimate contact is not always possible, the author recommends appropriate father substitutes. These may be other male relatives, club leaders, and male teachers in nursery schools and primary grades.

As the author points out, our society has evolved from one of home-centered, self-sustained family units to one of diverse specialization, with fathers frequently out of the home. This development is basic to the problem with which the author is concerned. The more complex society envisioned for the future offers little hope for closer, more frequent father-child contacts. If this prediction proves true, and there seems much to support it, the author's recommendation that we attract more male teachers to our nursery schools and kindergartens would be one logical solution.

The psychological and educational desirability of this suggestion cannot be questioned. The implementation of it is quite another matter, for it would undoubtedly be complicated by many factors. To cite only two, there would be negative public attitudes toward the male who would occupy such a "feminine" occupational role, and there is a marked tendency for males now in elementary education to advance rather quickly to administrative positions. The author recognizes the first obstacle, the problem of a prejudiced public, but does not deal with it extensively. He does not cite the second factor, but it would undoubtedly enter into the picture if the recent history of males in elementary education is used as basis for judgment. All too often such positions are only steppingstones to higher paying, more prestigious jobs in school administration.

Ostrovsky's book represents a welcome addition to the literature of child-rearing and education. The inclusion of discussion topics with each chapter, the excellent bibliography on father-child relationships, and the list of children's books about fathers and men add to its value. It is written in a style that should appeal to both professional educators and laymen. Although the author is psychologically sophisticated, he writes without cant or jargon. He manages to present case studies without dehumanizing the subjects: the children shine through. In the most complimentary way, the reviewer would add the criticism that the book is far too short. *Father to the Child* is a stimulating and well-written book that focuses our attention on a crucial but insufficiently explored aspect of children's lives.

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